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Présentée par **NGUYEN Mai Huong**

Structural Transformation and the Livestock Revolution in Vietnam: current situation and future scenarios for the dairy sector

Transformation Structurelle et Révolution de l'Élevage au Vietnam: état des lieux et scénario d'avenir pour le secteur laitier

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M. Bernard HUBERT, DR., AgroPolis International	Rapporteur
M. Philippe LEBAILLY, Professeur, Université de Liège	Rapporteur
M. Etienne MONTAIGNE, Professeur, Montpellier SupAgro	Examinateur
Mme. Isabelle BANTENWECK, Dr., ILRI	Examinatrice
M. Guillaume DUTEURTRE, Dr., CIRAD	Examinateur
Mme. Paule MOUSTIER, DR., CIRAD	Directrice de thèse

L'Ecole SupAgro de Montpellier
École Doctorale Économie-Gestion de Montpellier

THÈSE DE DOCTORAT

Présenté par
NGUYEN Mai Huong

Spécialité: Sciences Économiques

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Sous la direction de :

Paule MOUSTIER, DR., UMR MOISA, CIRAD

Co-encadrée par :

Bruno DORIN, Dr., UMR CIRED, CIRAD
Guillaume DUTEURTRE, Dr. UMR SELMET, CIRAD

Composition du Jury

M. Bernard HUBERT, DR., Agropolis International	Rapporteur
M. Philippe LEBAILLY, Professeur, Université de Liège	Rapporteur
M. Etienne MONTAIGNE, Professeur, SupAgro Montpellier	Examinateur
Mme. Isabelle BANTENWECK, Dr., ILRI	Examinatrice
M. Guillaume DUTEURTRE, Dr., CIRAD	Examinateur
Mme. Paule Moustier, DR. CIRAD	Directrice de thèse

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Laboratoires d'accueil

UMR MOISA
CIRAD TA C-99/15
Département Environnements et Sociétés
73 rue J.F. Breton
34398 Montpellier Cedex 5
France

UMR SELMET
CIRAD TA C-112/A
Département Environnements et Sociétés
Campus international de Baillarguet
34398 Montpellier Cedex 5,
France

Laboratoire d'affection

Centre de Développement Rural
Institute de Politiques et Stratégie pour
L'Agriculture et le Développement Rural
16 Thuy Khue, Tay Ho, Hanoi,
Vietnam

CONTENTS

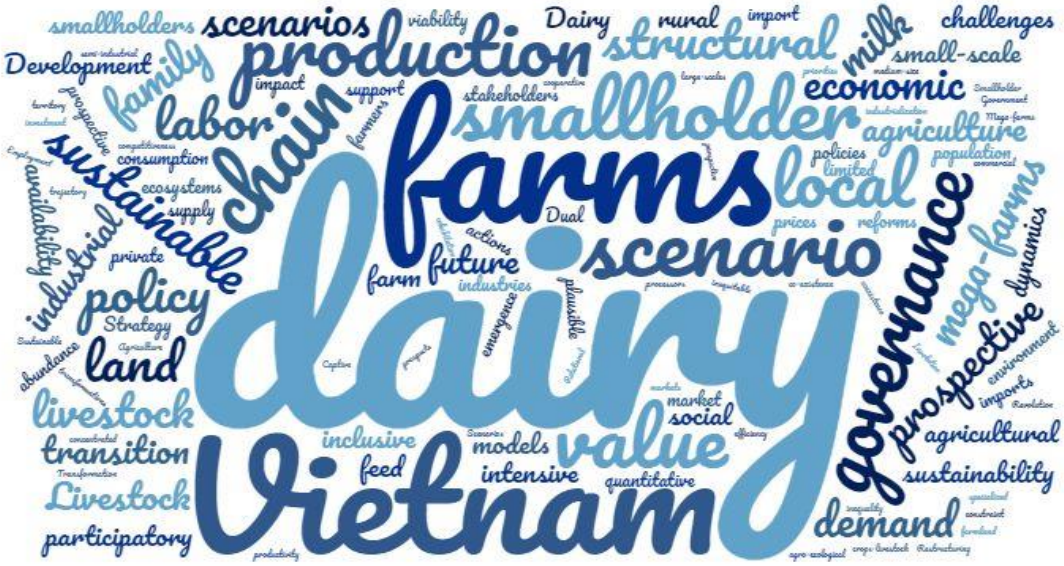
PREFACE

Livestock constitutes one of the most rapid changing sectors in the developing world and is therefore primarily concerned with the risks associated to non-sustainable intensification and industrialization of agriculture. The concept of "**livestock revolution**' has been proposed to underline this important transformation (Delgado et al., 1999). The rapid changes affecting livestock in Vietnam concern increasing demand, production techniques, farm structures, and the organization of the marketing chain. Those rapid changes are mainly driven by market forces and private firm strategies, but also by public rules affecting access to land, natural resources management, provisioning of services to producers, industrial technological transfer, food safety control, and marketing practices.

This thesis aims to discuss possible development visions for the dairy sector in Vietnam at the interface of economic, social and environmental issues. The ongoing livestock revolution calls for appropriate policies and interventions to address emerging issues of the sector (labor, feed, animal welfare, environmental consequences), especially in developing countries like Vietnam where livestock development confronts pressure placed by the land shortage, labor drain, technology-driven intensive production model, etc. The present work is a contribution to this effort by providing policy makers with future plausible development pathways as a reference for their policy-making works.

The thesis has been prepared in the context of a close collaboration between CIRAD laboratories (SELMET and MOISA research units) and a Vietnamese institute (RUDEC/IPSARD). SELMET puts diversity of livestock production systems and sustainable livestock sector in developing countries in their research agenda. MOISA focuses on strategies of different actors (public/private sector, individual/collective actor), governance and functioning institutions (markets, regulations) of the agricultural sector and food chains. RUDEC, a research center subordinated to the IPSARD/MARD, performs its research agenda in view of bottom-up policy advocacy in the field of agriculture and rural development. These teams share interest in and vision for economic, social, and environmental implications of livestock transformations (sector dynamics, innovations and institutions, governance, sustainable and inclusive development).

The thesis is framed in the Revalter project (Multi-scale assessment of development pathway of livestock sector in Vietnam) funded by ANR Biosphere 2013-2016. The project aims at promoting a new vision of livestock development in Vietnam, a country faced with extremely rapid i**ntensification** and **industrialization** of the sector, by conducting a systemic approach of livestock-ecosystems relationships documented at 3 levels: farm, territories, and sub-sectors. Four major concepts are used in the project to address the complex questions related to sustainable livestock development: **transition, governance, viability and sustainability**.



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ABSTRACT

In Vietnam, the dairy sector has emerged since the 2000s, in response to the rapid growth of the demand for dairy products. After having supported small-scale dairy production farms, the national policies since 2008 (the “2020 Livestock Development Strategy” in 2008, and the “Livestock sector Restructuring Action Plan towards greater Added Value and Sustainable Development” in 2014) highlighted the government’s priorities for large-scale and industrial farms. Those recent programs focused on reducing the import dependency to meet the increasing domestic demand and improving price competitiveness vis-à-vis imported dairy products. However, in the context of a rapid transition of the economy and of the ecosystems, smallholder and family farms are still the mainstay of the agricultural sector and continue to play an important role in sustainable development. The present study raises the question of the viability, sustainability and inclusiveness of different dairy farming models, taking into account the land constraint (farmland availability: 0.8 ha per farm, 0.12 ha per capita), labor abundance, especially in agriculture (50% of the total active population) as well as the environmental challenges related to animal products value chains. This thesis aims to contribute to the current policy debates in Vietnam in order to know whether the future dairy sector should be based on family farming or on large-scale production. The first section is dedicated to the analysis of the structural and agrarian transformation in relation to the ongoing dynamics of the livestock and dairy sector more weighted on the larger commercial farms. To better understand the market dynamics, the second section characterizes the governance of the dairy value chain in the largest milk-shed in the Red River Delta (Ba Vi district, Ha Noi). Based on interviews with 70 actors involved in local dairy value chain, the thesis underlines factors shaping a mixed relational-captive governance and the close connection between the local authorities and firms that might threaten the inclusion of smallholder dairy farmers in the chain. In the third section, we report on a participatory scenario planning exercise conducted with stakeholders of the dairy sector (one scenario planning seminar at district level, two seminars at the national level) to discuss about future policy orientations. In support to this participatory scenario planning, a quantitative simulation was done. 4 potential plausible scenarios for the Vietnamese dairy sector until 2030 were drawn up. In all scenarios, Vietnam still has to import large quantities of milk products and animal feed raw materials from abroad, but the 4 proposed scenarios differ on policy implications upon labor absorption, land availability and efficiency, and environmental impact. In particular, a “*Dual System*” scenario is discussed to accommodate different farm models (private mega-farms, specialized family farms and mixed crops-livestock farms) in view of balancing supply and demand as well as adapting to the puzzles of local land, labor and environment. Taking into account the co-existence and cohabitation of the different farms, appropriate policy actions are needed to ensure the sustainable and inclusive development of the dairy sector.

Keywords: *Structural transformation, Livestock Revolution, dairy sector, scenario, prospective, value chain governance, Vietnam*

RÉSUMÉ

Au Vietnam, le secteur laitier se développe depuis les années 2000, en réponse à la croissance rapide de la demande de produits laitiers. Après avoir soutenu les fermes de production laitière à petite échelle, les politiques nationales menées depuis 2008 (la Stratégie de développement de l'élevage 2020» en 2008 et le «Plan d'action pour la restructuration du secteur de l'élevage vers une plus grande valeur ajoutée et un développement durable en 2014) ont mis en évidence les priorités du gouvernement pour les grandes exploitations industrielles. Ces programmes récents visaient à réduire la dépendance à l'importation pour répondre à la demande intérieure croissante et à améliorer la compétitivité des prix vis-à-vis des produits laitiers importés. Cependant, dans le contexte d'une transition rapide de l'économie et des écosystèmes, les petites exploitations agricoles familiales demeurent un pilier du secteur agricole et continuent de jouer un rôle important dans le développement durable. La présente étude soulève la question de la viabilité, de la durabilité et de l'inclusivité de différents modèles d'élevage laitier, en tenant compte de la contrainte foncière (disponibilité des terres agricoles: 0,8 ha par ferme, 0,12 ha par habitant), de l'abondance de la main d'œuvre, en particulier dans l'agriculture (50% de la population active totale) ainsi que des défis environnementaux liés aux chaînes de valeur des produits d'origine animale. L'objectif de cette thèse est de contribuer aux débats politiques actuels au Vietnam afin de savoir si le futur secteur laitier devrait être basé sur une agriculture familiale ou sur une production à grande échelle. La première section est consacrée à l'analyse de la transformation structurelle et agraire en relation avec les trajectoires du secteur de l'élevage où les grandes exploitations commerciales deviennent nombreuses. Afin de mieux comprendre la dynamique du marché, la deuxième section caractérise la gouvernance de la chaîne de valeur laitière au Vietnam dans le bassin laitier du delta du Fleuve Rouge (district de Ba Vi, Ha Noi). A travers les entretiens réalisés avec 70 acteurs impliqués dans la filière laitière locale, la thèse souligne les facteurs de la gouvernance mixte (gouvernance relationnelle et captive) et le lien étroit entre les autorités locales et les entreprises qui pourraient menacer l'intégration des petits producteurs laitiers dans la chaîne de valeur. Dans la troisième section, nous faisons un rapport sur un exercice participatif des scénarios prospectifs que nous avons mené auprès des acteurs du secteur laitier (un panel de scénarios au district, deux séminaires de scénarios au niveau national) afin de discuter des orientations politiques futures. À l'appui de cette planification de scénarios participatifs, une simulation quantitative a été faite pour établir 4 scénarios plausibles pour le secteur laitier au Vietnam d'ici 2030. Dans tous les scénarios, le Vietnam doit encore importer de grandes quantités de produits laitiers et d'aliments pour animaux. Mais les 4 scénarios proposés diffèrent sur les implications politiques pour l'emploi, la disponibilité et l'efficience de terre et l'impact sur l'environnement. En particulier, le scénario «Système Duel» se base sur la cohabitation des différents modèles agricoles (méga-fermes privées, fermes familiales spécialisées et fermes de polyculture-élevage) en vue d'équilibrer l'offre et la demande ainsi que de s'adapter aux contraintes du foncier, du travail de l'environnement. Compte tenu de la coexistence et de la cohabitation des différents types de fermes, des mesures politiques appropriées sont nécessaires pour assurer le développement durable et inclusif du secteur laitier.

Mots clés: *transformation structurelle, Révolution de l'Élevage, secteur laitier, scénarios, prospective, gouvernance de la filière, Vietnam*

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SIGLES ET ACRONYMES

Arg.	Agriculture	Agriculture
ADB	Asian Development Bank	Banque asiatique de développement (BAD)
AE	Allocative Efficiency	Efficacité Allocative
AgroCensus	Rural, Agricultural and Fishery Census	Recensement de la Rural, de l'Agriculture et de la Pêche
ASEAN	Association of Southeast Asian Nations	Association des nations de l'Asie du Sud-Est
CH	Central Highland	Plateau Central
CIRAD	French Agricultural Research Centre for International Development	Centre de coopération internationale en recherche agronomique pour le développement
DLP	Department of Livestock Production	Département de la Production d'Elevage
FAO	Food and Agriculture Organization of United Nations	Organisation des Nations unies pour l'alimentation et l'agriculture
FCV	Frieslandcampina Vietnam (dairy company)	Frieslandcampina Vietnam (laiterie)
FTA	Free Trade Agreement	Accord de libre-échange
GDP	Gross Domestic Product	Produit Intérieure Brut (PIB)
GNP	Gross National Product	Produit National Brute (PNB)
Gov	Government	Gouvernement
GSO	General Statistics Office	Bureau des Statistics General
Ha	Hectare	Hectare
HF	Hostein – Friesian (cow breed)	Hostein – Friesian (race bovine)
HH	Household	Ménage
IDP	International Dairy JSC.	
Ind.	Industry	Industrie
IFPRI	International Food Policy Research Institute	Institut international de recherche sur les politiques alimentaires
IPSARD	Institute of Policy and Strategy for Agriculture and Rural Development	Institut de Politiques et Stratégies pour l'Agriculture et le Développement Rural
MARD	Ministry of Agriculture and Rural Development	Ministère de l'Agriculture et le Développent Rural

MOISA	Research Unit of Markets, Organizations, Institutions and Strategies of Actors	UMR Marchés, Organisations, Institutions, et Stratégies d'Acteurs
MOIT	Ministry of Industry and Trade	Ministère de l'Industrie et du Commerce
MRD	Mekong River Delta	Delta du Mekong
NMR	Northern Mountaious Region	Region des Montagnes du Nord
PM	Prime Minister	Premier Ministre
PPP	Public – Private Parnership	Partenariat Public-Privé
RRD	Red River Delta	Delta du Fleuve Rouge
RUDEC	Rural Development Center	Centre de Développement Rural
SEA	Southeast Asia	Asie du Sud-Est
SELMET	Research Unit of Mediterranean and tropical livestock system	UMR Systèmes d'élevages méditerranéens et tropicaux
Ser.	Service	Service
TE	Technical Efficiency	Efficacité Technique
TFP	Total Factor Productivity	Productivité Totale des Facteurs
UHT	Ultra-high Temperature Processing	Upérisation à Haute Température.
USAID	The United States Agency for International Development	L'Agence des États-Unis pour le développement international
USD	United States Dollar	Dollar américain
WB	World Bank	Banque Mondiale
VHLSS	Vietnam Household Living Standard Survey	Enquête nationale sur les niveaux de vie des ménages
VLSS	Vietnam Living Standards Survey	Enquête nationale sur les niveaux de vie
VND	Vietnamese Dong (Vietnamese currency)	Dong vietnamien (Monnaie vietnamienne)

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LIST OF COMMUNICATIONS AND ARTICLES

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Nguyen Mai Huong, JD Cesaro, Pham Duy Khanh, Hoang Vu Quang, Nguyen Mai Huong, Guillaume Duteurtre, 2016. «Hướng đi nào bền vững cho phát triển chăn nuôi bò sữa ở Việt Nam: sản xuất nông hộ hay đầu tư qui mô lớn» [Orientations towards sustainable development of the dairy sector in Vietnam: Smallholder farming or large-scale investment?». Tạp chí khoa học công nghệ chăn nuôi (Journal of Animal Science and Technology). 61 (March): 12-21

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CHAPTER 1

GENERAL INTRODUCTION

1. Context: Livestock Revolution in the agricultural transformations

After several decades of research works focused on agriculture productivity, the international scientific community is now tackling the tough question of how to produce in a more sustainable manner. To respond to the tremendous expansion of demand for food resulting from population growth, rapid urbanization, income improvement and diet change, the world agriculture is expected to almost double its output production until 2050 (World Bank 2009b; Griffon 2010; FAO 2012). In this context, it is crucial to better understand dynamics of agricultural and livestock system in relation with the entire society in view of developing ecologically intensified production systems and identifying appropriate governance mechanism and institutional framework in favor of sustainable transformation of agriculture and rural ecosystem (Steinfeld et al. 2010; Paillard et al 2014). This emerging scientific paradigm (Griffon 2006) underlines the importance of tackling rural and agricultural development issues in developing and emerging nations, where agriculture and livestock production has to increase faster than in the developed world. Moreover, Southern countries, that are characterized by labor abundance and/or land constraints, appear to be highly vulnerable to environmental changes, economic competition and price instability, and heavily concerned with social and demographic changes (IPCC 2007; World Bank 2009b; Steinfeld et al. 2010; World Bank 2010).

1.1. Structural transformations in developing world

Structural transformations which are defined by the flows of labor moving away from the "traditional" (subsistence agriculture) to the "modern" sectors (industry and services) is the subject of an abundant literature in development economics (Lewis 1954; Johnston and Mellor 1961; Kuznets 1966; Chenery 1979; Barrett 1998; Chenery and Srinivasan 1998; Timmer 2009a; Herrendorf et al. 2014). Table 1.1 presents the speed of reduction of agricultural GDP and employment shares in Asian countries. The questions of whether these countries will follow the developed countries into a "World Without Agriculture" (Timmer 2009a, 2009b) where the share of agriculture in both total employment and value added is about 3% while labour productivity across the agricultural and non-agricultural sectors has converged (Larson and Mundlak 1997), are calling for in-depth researches and studies. There is a number of publications on the structural transformations in Asian countries (Taylor 1993; Ghanes Thapa 2009; Tisdell 2010; Lin 2011; Viswanathan et al. 2012; Binswanger-Mkhize 2013; Timmer 2013; Newman and Kinghan 2015). Some of them show how economic growth and structural transformation have resulted in the dynamic evolution of food system and livestock commodities, and

how this dynamic evolution has been produced by the consumption and production linkages arising from technological changes and institutional innovations (Hayami and Ruttan 1985). And many assume that technical change based on "modern" technologies from developed countries should lead Asian emerging countries to the prosperity of a "world without agriculture" as now in Japan.

Table 1.1: Agriculture GDP and employment shares in Asian countries: speed of reduction (1980s-2000s)

Country	Period covered	Agricultural GDP shares (OS) (%)		Speed of reduction OS (% per year)	Agriculture's employment share (ES) (%)		Speed of reduction ES (% per year)
		Start	End		Start	End	
Bangladesh	1984-2005	32.3	20.1	2.13	58.5	48.1	0.91
China	1980-2008	30.2	10.7	3.51	68.7	39.6	1.88
India	1994-2010	28.5	19.0	2.36	61.9	51.1	1.12
Indonesia	1985-2010	23.2	15.3	1.59	54.7	38.3	1.36
Thailand	1980-2009	23.2	11.5	2.31	70.8	41.5	1.76
Vietnam	1996-2006	27.8	20.4	2.77	70.0	51.7	2.72
Japan	1980-2009	3.6	1.4	3.10	10.4	3.7	3.39
South Korea	1980-2010	16.2	2.6	5.73	34.0	6.6	5.15

Source: Briones and Felipe (2013)

1.2. Livestock Revolution

In the world, 1.3 billon poor living in the developing countries depend directly on directly on livestock for their livelihood (World Bank 2009a). Livestock contributes to the 40% of the global agricultural GDP and represents 33% of agricultural GDP in developing countries (World Bank 2009a; Thornton 2010). Livestock provides significant nutrition intake: 17% of global calorie consumption and 33% of global protein consumption (Rosegrant et al. 2009). Since the 1980s, the growth of per capita animal-product consumption has outpaced the other major food commodities (cereal, roots and tubers) in developing countries (FAO 2009). Growing demand for livestock products make livestock constitute one of the most rapid changing sectors in the developing world, especially in Asia (Table 1.2). Livestock is therefore primarily concerned with the risks associated to non-sustainable intensification of the industrialization of agriculture. The concept of "Livestock Revolution" underlines this important transformation (Delgado et al. 1999). Upon heterogeneous transformation of the livestock systems (ruminants or non-ruminants), "*the sustain rise in demand for animal origin, driven by growing population, increasing consumer affluence, and increasing urbanization, is underpinned by structural changes along the whole animal food supply chain"* (Steinfeld et al. 2006).

Table 1.2**:** Livestock production in Asian developing countries (1990-2014)

	1990	2000	2010	2014	2014/1990 (times)
Meat, total (tons)					
China	28,105,360	56,038,820	77,273,240	84,797,637	3.0
India	3,657,118	4,443,928	6,084,075	6,601,016	1.8
Thailand	1,537,098	2,044,484	2,396,252	2,955,989	1.9
Indonesia	1,448,400	1,695,263	2,848,680	3,380,179	2.3
Vietnam	1,078,935	1,981,805	3,987,186	4,488,475	4.2
Bangladesh	316,661	449,327	607,287	652,358	2.1
Milk, total (tons)					
India	53,678,000	79,661,000	121,847,000	146,313,530	2.7
China	6,820,400	11,986,000	40,803,769	42,198,273	6.2
Bangladesh	1,593,503	2,136,610	3,398,000	3,697,495	2.3
Indonesia	599,155	786,957	1,313,177	1,206,981	2.0
Thailand	130,278	520,115	911,000	1,067,452	8.2
Vietnam	60,471	84,525	338,662	581,606	9.6
Milk, whole fresh cow (tons)					
India	22,240,000	32,967,000	54,903,000	66,423,450	3.0
China	4,157,000	8,274,000	35,756,000	37,246,400	9.0
Bangladesh	743,796	778,000	829,600	838,813	1.1
Indonesia	345,600	497,857	909,533	800,749	2.3
Thailand	130,278	520,115	911,000	1,067,452	8.2
Vietnam	36,000	54,456	306,662	549,533	15.3

Source: FAOSTAT (2014)

While the Green Revolution follows supply-driven dynamics, the Livestock Revolution is attributed to demand-driven trends (Sumberg and Thompson 2013). Global production of meat and milk is projected to double by 2050[1] (Steinfeld et al. 2006) to feed 9 billion people (Paillard et al. 2014). In addition to the demographic boom, rapid urbanization linked with changing diet patterns, historical, cultural and religious factors affect acceptability and demand for livestock products. The contributors of the livestock industry to per capita income has reached unexpected levels, especially in Asia (Quirke et al. 2003). And livestock development offers significant challenges for agro-ecosystems throughout the developing world, because of its various contributors to agricultural systems, urban livelihoods and grassland eco-regions (Sombilla and Hardy 2005; Duteurtre and Faye 2009; Alary et al. 2011). Firstly, the feed requirements of different livestock types and species place burdens on the agriculture development discourse. Feed availability (grain, fodder crops, pastures, agricultural and industrial by-products) spells out the scope for expansion and intensification of production at different levels (farm, territory and sector). Secondly, limited access to land in populous nations explains

[1] Worldwide milk production is expected to increase from 664 million tonnes (in 2006) to 1077 million tonnes (by 2050), and meat production will double from 258 to 455 million tonnes (FAO 2012)

the development of intensive (even landless) systems for pig, poultry and milk production. This tendency is spatially construed by locating livestock production in urban and peri-urban areas, or in areas of disadvantaged agronomic conditions (Gerber et al. 2005, 2010). Thirdly, considerable emphasis has been put on the environmental impacts caused by the Livestock Revolution (De Haan et al. 1997; Delgado et al. 1999; Herrero et al. 2015). Highlighted environmental issues associate with both 'low-intensive' (primarily land degradation) and 'high-intensive' industrial production systems (water pollution, CH_4 and N_2O emissions, environmental damage associated with the production of feed crops with chemical fertilizers, pesticides and so on). Livestock systems, especially "high-intensive" system, are less resilient and more vulnerable to environmental changes (Steinfeld et al. 2006). In addition, public health risks and concerns (zoonosis, animal waste and food contamination) are also underlined in policy agenda defining production intensity, production size, and spatial clustering of production holdings in developing countries. Looking forward to the future (2020/2030 or 2050 horizon), it is expected that the structural shifts in agriculture being brought by population growth and changing diets (towards more foods of animal origin) will continue, and that increasing dependency in international trade for both feed grains and animal products will strengthen (Delgado et al. 1999; FAO 2012).

1.3. Small farms versus large industrial farms

Out of more than 570 million farms in the world, more than 475 million farms are smaller than 2 ha, operating about 12% of the world's agricultural land (Lowder et al. 2016). Livestock is considered to provide livelihoods and a pathway out of poverty to smallholder farmers in developing world (Brown 2003; Thornton et al. 2006). However, the industrial of livestock production has reached most countries in the world, with the emergence of large-scale and industrial farms. The livestock industry is growing seven times faster than smallholder livestock systems (Gura 2008). Upton (2000) and Quirke et al. (2003) analyzed the Livestock Revolution for small milk producers in Kenya, and highlighted the "*complementary and inter-independent input and product markets for large- and small-scale producers*" because of their complementarity and inter-dependence. "Large-scale producers may serve a useful function in contributing to the growth of the smallholder sector". While Upton (2000) warns against policies that discriminate against larger-scale producers, Gura (2008) reaffirms that not large factory and multinational corporations, but small-scale family farms hold for more productivity, environmental sustainability, and more employment

Smallholders and commercial producers in Asia use very different technology than in Africa, so trade and liberalization is likely to affect them differently (Quirke et al. 2003). Experiences of smallholder livestock producers in the Philippines, India, Brazil, Thailand show that they can still "*compete with larger producers in many of the case studied under current market conditions, despite frequently paying higher prices for inputs due to economies of scale, receiving lower prices for their output due to higher transaction costs, and internalizing more of their environment costs. This is because of the saving of smaller units on an overhead items, lower labor costs per unit, and possibility more intensive supervision, leading to relatively high profit efficiencies.*" (Delgado et al. 2008).

Higher prices of feed grains also affect primarily commercial farmers (i.e. large specialized farms) since *"feed grains and feed concentrates are much more intensively used by commercial producers than by smallholders. Other things being equal, higher grain prices from trade liberalization are likely to increase the competitive position of smallholders relative to commercial producers"* (Quirke et al. 2003). The price spike of food and grains in 2008 impacting livestock producers in Asia and in Vietnam in particular, in three ways: (i) escalating production costs, especially expenditure on feeds (industrial feed, maize, oat, fish meal); (ii) declining profits of farmers; and (iii) prevalent epidemic diseases (blue-ear pig diseases, swine flu, FMD, etc.) (IPSARD 2009).

Viability of the livestock producers and livestock industry is determined by a number of variables, including economic performance, risk aversion, ability to respond to crisis, environmental and social sustainability as adaptive capacities (Dedieu 2009; Darnhofer et al. 2010; Astigarraga and Ingrand 2011) and labor absorption (Hostiou and Dedieu 2009). Sustainability refer to economic performance, protection of the natural environment, and social equity (Bockstaller et al. 2009; Coquil et al. 2009; Binder et al. 2010).

1.4. Vietnam in the play

1.4.1. Structural transformation, agriculture and employment in Vietnam

Since the mid-1980s, Vietnam has experienced a fundamental transformation of its socio-economic structure. From a poor country, Vietnam has emerged within few decades as a middle-income nation (World Bank 2011). The promulgation of new policies fostered Vietnam global economic integration, and scientific and technological advances brought out significant changes for the

> *«Vietnam needs to adopt the seemingly paradoxical stance of giving a high priority to raising agricultural productivity while recognizing the success can come only as agriculture declines as an employer of labor»*
>
> (World Bank, ADB, and UNDP 2000)

Vietnamese agricultural production, ranging from actors involved to products and technologies. As a result, demand for land, water, energy and food has increased, putting more and more pressure on natural resources and ecosystems, and increasing competition between different users.

Vietnam has been transforming thanks to the vast socio-economic reforms of *Doi Moi* in 1986, from "collectivism" and a "centrally planned economy" towards a "socialist-oriented market economy". The country has enjoyed a rapid economic growth (average GDP growth rate of 7.4% in the 1990s, and 6.8% in the 2000s) (OECD 2015) that was accompanied by a radical change in the structure of the economy and in the society. The share of agriculture in GDP (current price) decreased from 38.6% to 18.4% between 1986 and 2013 (Son 2009; Cling et al. 2009). Nevertheless, Vietnam has emerged as one of the most dynamic agricultural countries in the world and successfully escaped from food shortages endured during the early 1980s. Agricultural GDP has increased by 5.8% per year over the last 3 decades and made great contribution to the reduction of rural poverty[2]. Today, the country is standing among the top world exporters of pepper (1st place), cashew nut (1st), rice (2nd), coffee (2nd), rubber (4th), and tea (5th) (OECD 2015). Agriculture still employs the largest share of total employment despite we have seen the decreasing share of agricultural employment in total employment, from 70% in 1986 to 46.3% in 2014 (WDI/WB 2014). Recent official statistics underlines the shift of rural households from farm activities to nonfarm activities, especially the diversification trend in urban areas (Fanchette 2011; McCaig and Pavcnik 2013). Total agricultural households went down from 11.3 million in 2001 to 9.3 million households in 2016. Of 15 million rural households (2011), 20% engaged in industrial and manufacturing activities, 19% involved in service provision[3] (GSO 2012).

1.4.2. Livestock Revolution in Vietnam

Asian countries have well characterized and defined the demand-driven "Livestock Revolution" (Delgado et al. 1999). With a total population of 90 million people in 2013, Vietnam is an outstanding illustration for the global questions about the rapid transition of livestock sector in response to the fast growing demand in the developing world, and its implications on rural systems. Many ingredients of this revolution are clearly present in Vietnam: strong growth of population (annual growth of 1.2% and 1.05% for the 1999-

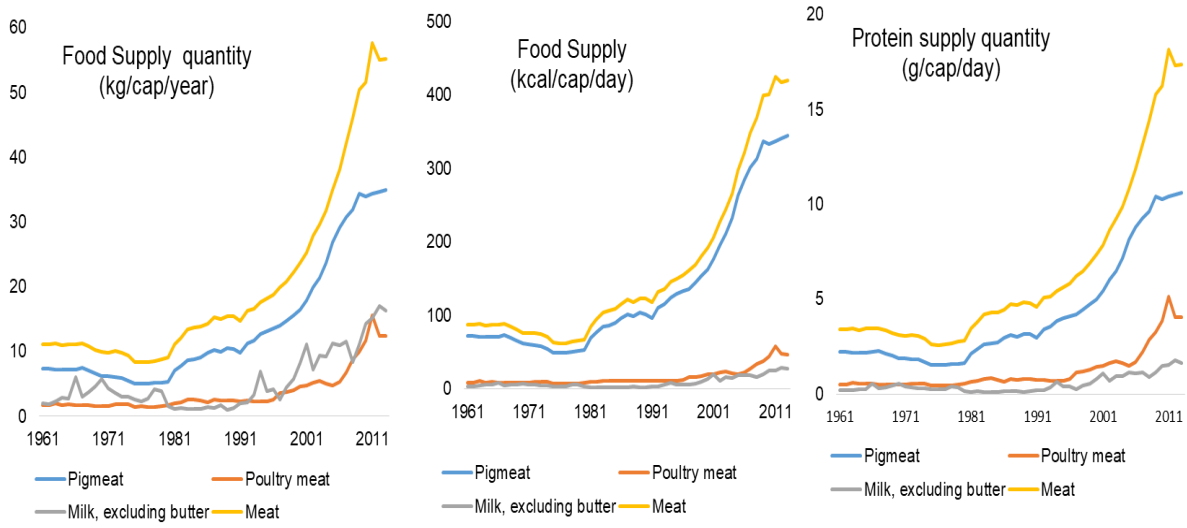
[2] Between 1990 and 2000, the agriculture sector saw 3.9% GDP growth, 1.5% employment growth and 2.7% labor productivity growth. Between 2000 – 2013, the agriculture sector witnessed 3.5% GDP growth, 0.1% employment growth and 3.4% labor productivity growth (World Bank and MPI 2016).

[3] Of 13 million rural households in 2001, rural households engaged in industry and service were 6% and 10%, respectively.

2009 and 2011-2013 period, respectively) (GSO 2015), rapid urbanization (urban population increasing from 20% in 1986 to 34% in 2015)[4] (World Bank and MPI 2016), high economic growth over the last 30 years (growth maintained despite the regional and global financial crisis and economic downturn), and declining trend in the headcount poverty. In recent years, the livestock has been growing faster than agriculture as a whole: annual growth of livestock added value at 5.3% for the 2005-2013 period (DLP 2015). The livestock sub-sector accounts for around 26.4% of the agriculture output and plays a crucial role in rural livelihoods (GSO 2015). Throughout the country, rural livelihoods widely depend on pig production (65% of rural households) and poultry production (70%) (GSO 2012).

The Livestock Revolution has been well underway in Vietnam with the increasing supply and consumption of meat and milk (Figure 1.1). This changes are driven by steadily growth in per capita incomes accompanied by the emergence of a new livestock industry. Between 2000 and 2010, poultry meat and pig meat production more than doubled, and milk production was multiplied by 6 times (Table 1.2). Still, the local demand remains unsatisfied by local production and the country continues to import huge amount of meat, milk products and animal feed (Que 1998; Son 2013; OECD 2015; DLP 2015).

Figure 1.1: Food supply by Livestock products (1961-2013)



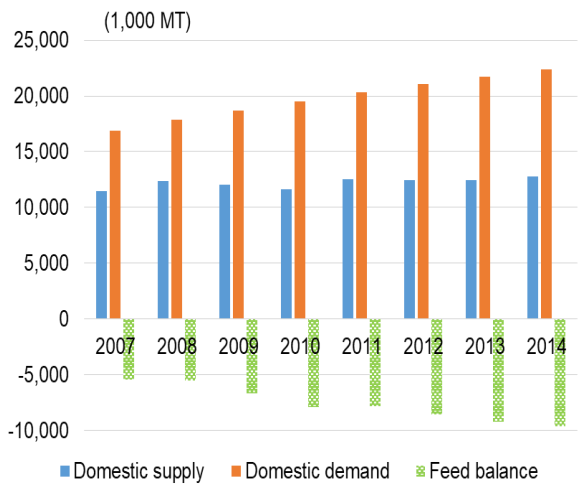
Source: FAOSTAT (2014)

The livestock sector expansion creates a huge demand for maize and cassava, which has put higher pressure on land and ecosystems (Castella and Quang 2002). The feed

[4] Between 1986 and 2015, urban population increased by 3.4 % a year, from 12 million to more than 30 million people. Between 2000 and 2015, urban land increased by 652,144 ha and urban population went up by 10.2 million people

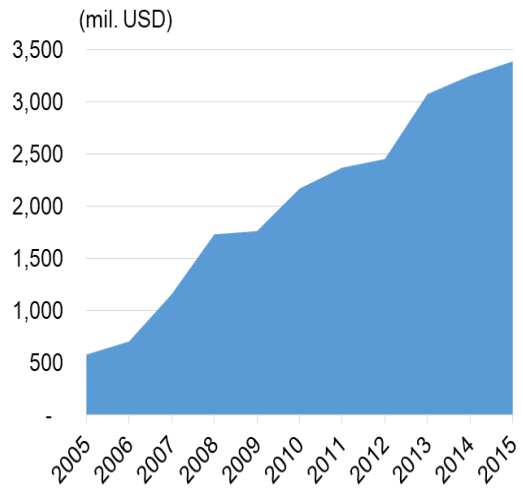
industry just satisfies 58% of the domestic demand (Figure 1.2), so the country has to spend around US$ 2-3 billion every year to import animal feed and raw materials (Figure 1.3) (Vietnam Customs 2016; GSO 2017). Feed imports are mainly ingredients rich in protein (soybean meals: 66%, meat meals and fish meals: 18%; and other oil cakes: 8%) imported from Argentina, India and the US. Regarding organizational aspects, the sector is dominated by foreign and join-venture enterprises which manufacture more than 60% of the total processed feed output. Around 75% of this production is localized in the South of the country (Giao 2012; Phuong et al. 2010a, 2010b; AgroInfo 2015). This new pressures on land for feed cultivation, and the escalating dependence on feed imports, are posing concerns about the future of rural ecosystems that are also more and more vulnerable to climate change. Vietnam is considered as one of the five countries in the world that will be the most affected by climate change (ADB 2009; World Bank 2010). Climate change goes with increasing frequency, intensity, variations of extreme weather patterns and natural disasters (increased temperature, draughts, flood, soil salinity, etc.) which reduce yields or productivity of crops and livestock.

Figure 1.2: Animal feed – Domestic demand and supply (2007-2014)



Source: DLP, 2015

Figure 1.3: Feed importation value (2005-2015)



Source: GSO, 2017

Livestock transformations are also said to alter the crop-livestock production systems which is popular in Vietnam: rice-based crop-livestock systems in the lowland (Red River Delta and Mekong River Delta), rainfed crop-livestock agriculture in the uplands (maize, tea, coffee-based systems associated to draught animals, pigs, and ruminant breeding in the Northern Mountains and Central Highlands). Competition between crops and livestock include competition on land (especially irrigated land), labor (due to trade-off in work calendar), and inputs (Sombilla and Hardy 2005; Dang Kim Son 2009; The Anh et al. 2010).

The landless livestock systems in Vietnam are characterized by the proximity to urban markets, transport infrastructure, processing capacity (scale, intensity, commercial logistics associated with environmental, diseases, public health and animal welfare issues). It has been witnessing higher investment, technology transfer, innovations and international integration. In the country of land shortage in Vietnam, the disconnect between livestock production and a local land has pose challenges to sustainability. Furthermore, these systems are likely to face competition from imported products, especially for dairy products

1.4.3. Policies and Institutions at Stake

A number of policies have stimulated and accompanied the rapid agricultural transition. The three-pillar of *Tam Nong* refer to the 3 National Target Programs (NTPs) - New rural development, Climate change, and Training for Rural people - taking into account the economic, social and environmental issues. The recent Government vision for restructuring the agricultural sector (Decision 899/2013/QD-TTg of the Prime Minister) toward raising value added and promoting sustainable development. It is planned to sustain the agricultural growth rate, to increase agricultural productivity for higher income, and to diversify agricultural production. The Government prioritizes the stable growth and preventing the decline in the comparative advantage of the sector.

The "Strategy for Livestock Development to 2020" (2008) and the more recent "Scheme for Restructuring Livestock Sector" (2014) aim to encouraging rapid increase of livestock production in order to respond to the growing demand. These visions are focused on promoting intensification and industrialization of the livestock sector through the development of large farms. The new adverse environmental and social threats posed by this 'livestock revolution' are not clearly identified.

> "[….] *But whether the traditional livestock enterprises of the rural poor can coexist with increasing industrialization of livestock production is an open question*"
>
> (Delgado et al. 1999, p.37)

As the economy develops and wages increase, labor-intensive small-scale farming becomes costly (Otsuka and Estudillo 2010). However, the future of food security in Asia still depends on the performance of small farmers (Timmer 2013). Accordingly, policy makers in Vietnam, as their regional peers, are challenged by restructuring the agriculture sector and enabling local farmers to adapt to the changing economic landscape and uncertainties. Policies can help or hinder the competitiveness of small-scale livestock producers. They thus required careful consideration. Where support services are weak, supply chains are complex, or where efforts to control

animal diseases are thorough, '*evidence of gains for producers, particularly smallholders, is minimal*' (Steinfeld et al. 2010).

2. Problematic, objective of the thesis and research question

2.1. Problematic

2.1.1. Structural transformation in a land-constrained country

In Vietnam, as in many other Asian countries, we observe simultaneously: (a) important land constraints linked to the concentration of human populations, (b) an increase in the consumption of animal products (milk in India, pork in China, milk and pork in Vietnam ...) linked to population growth and improved living standards. Growing demand for animal products dramatically intensifies the pressure on land, since each calorie or protein consumed in these forms (milk, meat, eggs) requires an average of three times as much of human-edible plant equivalent (cereals and oilseeds in particular) (Dorin 2011; Dorin and Le Cotty 2012; Le Cotty and Dorin 2012)[5]. And non-human-edible biomass (fodder, pasture, crop residue or food, etc.) are also required to feed animals, especially the ruminating ones.

This growth has multiple implications, notably in the following two dimensions:

(a) The restructuring of agricultural sector (composition of sub-sectors, localization of agricultural workers and farm holdings, optimal farm size, etc.) in relative with non-agricultural sectors regarding resources endowment and capital allocation (land, labor, financial and social capitals);

(b) international trade, particularly with a strong development of feed imports of Asian countries (mainly soybean and maize meal) from regions of much lower land pressure (as in the America continent);

(c) degradation of local and global environmental goods: increasing consumption of water, fertilizers and pesticides to produce feed, overexploitation of land and/or cultivation of forests or pastures (two important carbon and biodiversity reservoirs), greenhouse gas emissions (CH_4 and N_2O in particular) related to the production of animal feed and to the breeding activity, and so on.

[5] Global average level in the 2000s: This average level (3 to 1) is different among the countries and tends to increase along time with the increasing industrial livestock which have huge demand for food biomass (maize, soya meals, …) and also non-food biomass (forage, fodder, …)

This growth also acutely denotes the general trajectory of growth and structural transformation of the Asian economies, especially in Vietnam. Can Vietnam, a land-squeeze and labor-abundant country, follow the "modern growth" pathways of industrialized countries that are now finding themselves in a "world without agriculture" (Timmer 2009a, 2009b) (3% of GDP and 3% of the working population) where the labour productivity gap between agricultural and non-agricultural workers has vanished (eradication of ancestral rural poverty)? Are specialization, industrialization, mechanization and robotization of crop and livestock production, like in developed economies, correlated with a massive emigration of farmers to other sectors and cities, possible in Asian contexts at low economic, environmental and social costs? The answers to these questions seem very pessimistic unless there is profound socio-technical paradigm shift (Dorin et al. 2013; Dorin and Aubron 2016; Dorin 2017) that scenarios building may help to delineate in the case of Vietnam.

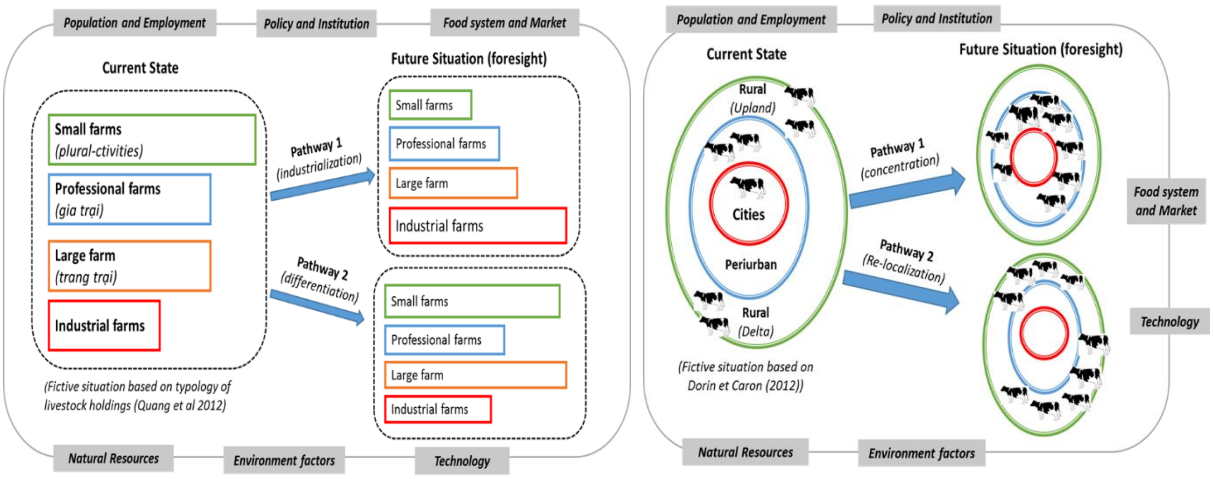
2.1.2. Governance of agricultural system in a landscape of uncertainties

Concept of "governance", in a purely descriptive and analytical sense, can be defined as "*any organized method of delivering public or collective services and goods according to specific logic and standards. Any organized form of this delivery (each institutional arrangement), operating according to specific standards, and implementing a specific logic, can then be considered to be a 'mode of governance'*" (Olivier de Sardan 2011). From different angles, modes of governance exhibit a great diversity (Meisel and Ould Aoudia 2008). In a given socio-ecosystem, "governance system" refers to multi-level organizations and rules that govern the use of natural resources (Ostrom 2009). In economics studies, governance refers to the inter-firm relationships through transaction characteristics and associated costs (Transaction Costs Economics (Williamson 1979, 1991)), industry structure and production process characteristic (Global Value Chain (Humphrey and Schmitz 2001; Gereffi 2001; Gereffi et al. 2005)), or trust and social embeddedness (Network Theory (Powell 1989; North 1990)).

In Vietnam, the transformation of modes of governance of the economy in general and agricultural systems in particular have changed progressively over the last 30 years: from centralized system to a more complex set of rules, where private actors (enterprises, farmers, etc.) play increasingly strong role (Salemink 2003; Clement 2007). In line with structural transformation process, the agricultural systems is in the midst of major changes – change in production organization, in product characteristics, in distribution, in technology, in size and structures of farms and firms, and in the geographical location of production and processing – that affect resources management strategies and

governance patterns (OECD 2015; World Bank 2016). The agricultural systems and livestock industry exhibit a number of challenging characteristics. It is highly volatile, both in production and market conditions (Que 1998; Son 2013; The Anh and Son 2013). The participation of farmers in value chains and modern distribution revolution (Reardon et al. 2012) are likely to have a substantial impact on agriculture system (Thapa and Gaiha 2014). Moreover, the agricultural sector has faced growing competition for labor, land, water and other resources from industries, services and cities (OECD 2015; World Bank 2016). These changes suggest three fundamental critical issues for the agriculture/livestock sector: (1) responding to the change in the new organization of the commodity chain and the territory landscape; (2) developing and adopting technology and innovation; and (3) decisions made to adapt to an environment of increasing risk and uncertainty. Vision for a modernizing agro-food system underlines the "*leading-less and facilitating-more*" role of the State (World Bank 2016). Therefore, understanding the networks and governance systems (including public regulations, firms, and social groups), markets as social construction (Dorward et al. 2005), modes of the regulations of the commodity chains (institutional elements such as level of concentration, barriers to entry, market information flows, quality management, etc.) will help to anticipate the future development pathways (Figure 1.4).

Figure 1.4: Potential livestock development pathways in Vietnam



Note: Figure 4a (left): Dynamics of production model (farm size); Figure 4b (right): Territorial dynamics (livestock zoning). The grey boxes in the periphery capture the factors driving development trajectories.

2.1.3. Dairy sector in the Vietnamese structural transformation

Vietnam has not a long tradition of milk production and consumption. Dairy cow production commenced in Vietnam in the early 20th century, and it is only since the 1990s that production manifest an impressive development backstopped by family farming of

small scale. Surges in the domestic demand for milk and milk products have encouraged domestic production but also importation since the local industry can currently satisfy only 30% of the domestic market. Vietnam spends today more than one billion dollar to import milk products, especially milk powder. To reduce the trade deficit (supply and demand), the public policies aim, from 2008, to support the development of dairy farms of larger scale (more than 30 dairy cows) and industrial farms (more than 500 cows). Over the last 5 years (2009 - 2014), a number of dairy farm complex projects have been installed. Yet, the milk production system in Vietnam is still dominated by the family farming (less than 5 cows) around the cities, and dairy livestock has made an important contribution to the family income and job opportunities in rural areas (Tung and Huyen 2009). It is likely that small-scale farms face lesser problems in handling waste than larger and industrial farms, but are more susceptible to market factors (price fluctuation, collecting schemes of the milk companies) and sensitive to the government policies in favor of large-scale farms.

In brief, from the production side, the revolution happening in Vietnam's in dairy sector is conceptualized as an integrated outcome of many different developments, with some being more revolutionary than others, especially the come into being of mega-farms of thousands cows. Policy vision to favor the large-scale production model (not only dairy but also pig and poultry) in view of limiting the imports has fueled the debates over the sustainable and inclusive development of the dairy sector in particular and of the livestock sector in general (Box 1). A number of national seminars and workshops have been conducted to discuss about the appropriate models (small-scale farms or large-scale industrial farms) and sustainability of these models in Vietnam context (Huong et al. 2016). However, these local debates on livestock and dairy sustainability have focused on partial aspects of sustainability (sanitary quality, effluent pollution, market integration…) and, above all, are based on cow productivity in milk and economic performance of the farms (Tien et al. 2002; Garcia et al. 2006; Phong 2009; Pedregal and Luan 2009; Nathalie Hostiou et al. 2012; Saenger et al. 2013; Nga et al. 2013). There is a need for a more encompassing framework to link with other issues such as demographic, land and land fragmentation, market and climate change. Steinfeld et al. (2010) highlighted four momentums of livestock transformations: (i) *market changes* refer to trends in consumption, retail, supply chains, food production systems, changes in trade patterns, quality standards; (ii) *natural resources endowment* encompasses land, water, fossil fuels, climate change, and weather; (iii) *technology* available for production and processing (genetics, nutrition, health); and (iv) *policy and institutions* incorporated by regulatory framework and incentives. We embedded this framework into the one of structural transformation to show the various dimensions of our problematic and how we

intend to study the past and possible future role of dairy in the structural transformation of the Vietnamese economy (Figure 1.5)

Box 1: Different standpoints on dairy farming models

Professor Le Viet Ly (former Deputy Director of the National Institute of Animal Sciences) put that in a populated country like Vietnam, the employment and income of farmers are critical issues. He also underlines the very high environmental costs incurred by the concentrated and industrial-scale farms. Accordingly, it is needed to diversify the milk production in Vietnam.

("Mô hình chăn nuôi bò sữa hiện đại" [Model of Modern Dairy Farming] on 31st July 2010, at http://nhandan.com.vn/kinhte/thoi_su/item/9772402_html)

Dr. Dang Kim Son, Former Director of IPSARD: *"TH Milk project is an outstanding model of the dairy farming and processing revolution in Vietnam".*

Mr. Nguyen Quan, Former Minister of Sciences and Technology: It is necessary to encourage and support the large-scale dairy farms in order to take advantages of science and high technology

Mr. Nguyen Cong Tan, Late Deputy Minister: *"Over the past 10 years, we have seen a number of encouraging results in dairy development. The expansion of efficient large-scale dairy farms opens opportunities for development of temperate dairy cows on the industrial scale in different regions across the country"*

(Communications at the workshop "Application of high technology and sustainable development of diary sector in Vietnam", Hanoi, 28th November 2013)

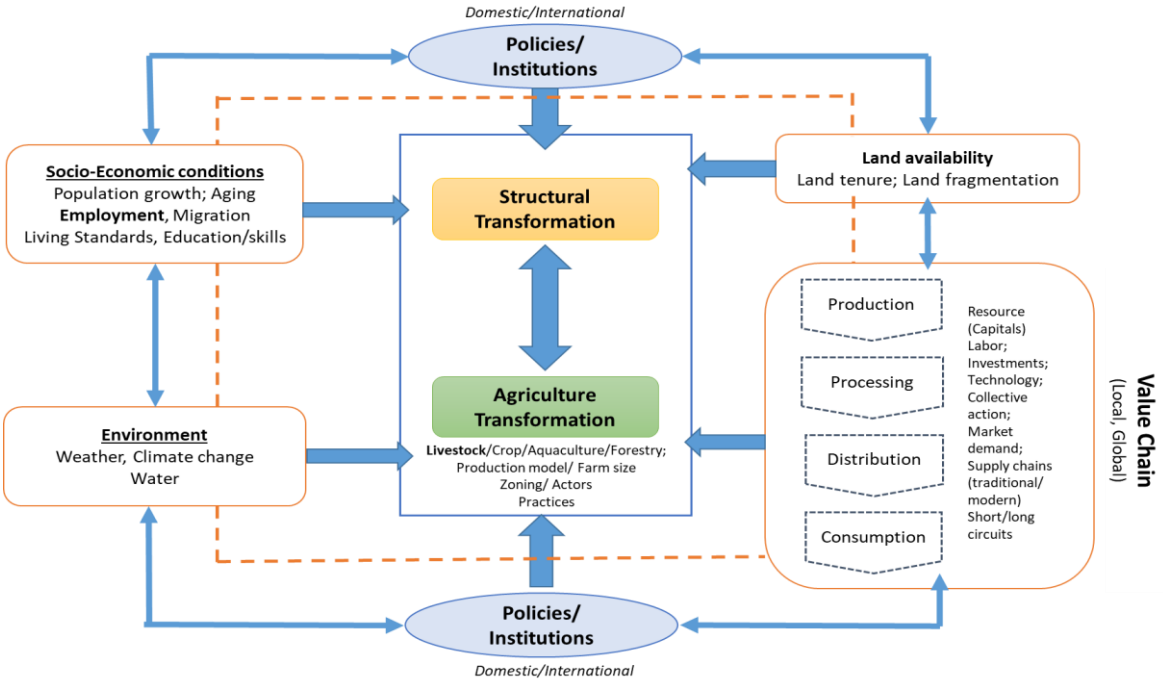
Vietnam Dairy Association (VDA) underlines the accommodation of different farm model: large-scale livestock farms (with high technology) and family livestock in order to generate income and livelihood for farmers. The only focus on the large-scale dairy farms will find be challenged by land availability, productivity, livelihoods for farmers whose land are reclaimed, and environmental management

("Ngành sữa Việt Nam" [Vietnamese Dairy Sector] on 03rd August 2015, at http://thoibao.today/paper/nganh-sua-viet-nam-117544)

Assoc. Prof. Dr. Hoang Kim Giao (former Director of the Department of Livestock Production; Chairman of the Vietnam Cattle Association Vietnam) said that increasing the dairy herd size is important. The dairy (family) farms should flow the intensive production and stabilize their herd at 50-100 cows to get higher efficiency, more sustainable and improved food safety. He also emphasized investments in concentrated farms equipped with hi-tech and advanced technology.

(Communication of the Communist Review, on 16th December 2015 http://dangcongsan.vn/kinh-te/phat-trien-nganh-chan-nuoi-bo-sua-trong-boi-canh-hoi-nhap-quoc-te-361295.html

Figure 1.5**:** The multiple dimensions of dairy development in the Vietnamese economy



2.2. Objective of the thesis

2.2.1. General objective

This research aims at contributing to the reflection about the possible development pathways in Vietnam (outstanding case of developing economy) in view of fruitful policy debates over sustainable and inclusive livestock (dairy) development. While the Vietnamese Government is implementing the Agricultural Restructuring Plan (ARP) and Sustainable Development Goals (SDGs), the thesis fuels the debates about the actions to valorize the agricultural sector – "in terms of triple bottom line of economical, socially and environmental sustainable development" (World Bank 2016). It also provides insights about the choice between the small farms and larger farms.

The thesis is distinguished from other research on agricultural and rural development in Vietnam by exploring the prospects for dairy production in response to the fast growing demand. Given the numerical importance of small-scale dairy producers and smallholder farmers while the key policies being pro large-scale and industrial farms, the study tries to consider the pros and cons of these production models from the sustainable and inclusive development perspective (raising income and relieving rural poverty).

Approach mobilized is integrating the analysis of politic-economic environment, the governance of the sector at local level and associated with the participative foresight

exercises to sketch the potential scenarios (taking into account the contrasted small-farms and large-scale farms).

2.2.2. Specific objectives

First, to locate the livestock sector in the overall dynamics of the structural transformation and agrarian transition. Positioning the sector in the historical development discourse shed lights on the potential trajectories in the middle and long run.

Second, to explore factors shaping the governance of the dairy sector in Vietnam. The better understanding of the sector governance mechanism draws ideas about the plausible institutions where the sector operates.

Third, to develop plausible scenarios for the development of the dairy sector towards 2030. The foresight scenarios will open up further discussions and dialogues for the sake of sustainable and inclusive development.

2.3. Research questions

Vietnam has been experiencing the demand-driven Livestock Revolution, which includes the dairy sector. In the context of continuous structural transformation and industrialization, there are underlying issues that must be identified in order to identify policy options for the livestock (dairy) sector so that the country, on one hand, can catch up with the ongoing revolution, but still embark on a more sustainable and inclusive development pathways. Accordingly, the thesis aborts the following research questions:

(i) Structural transformation, agriculture and employment: How far Vietnam follows the canonical model of structural transformation? How its agrarian changes diverge from neighboring Asian countries that are characterized by labor abundance and land constraint? What is the place and dynamics of the livestock sector in these structural changes and development discourse? These questions are answered in *Chapter 2*.

(ii) Livestock value chain: What is the governance of the Vietnamese livestock sector, in particular the dairy sector? How are the territorial and sector dynamics in the livestock revolution? These questions are addressed in *Chapter 3*.

(iii) Perspective for the dairy sector: What challenges lie ahead for the Vietnamese dairy sector? What sustainable models can be promoted in the future? What are the impacts and policy implications of different scenarios of change? These questions are answered in *Chapter 4*.

3. Structure of the thesis

The thesis is built basing on paper-format structure, incorporating 5 chapters as follows:

The **General Introduction (this Chapter 1)** is setting the scene of the thesis by incorporating the scientific and empirical environments in which the thesis perform it roles.

The **Chapter 2** analyzes the dynamics of **"Structural transformation, agriculture and employment in Vietnam"**. Structural transformation and agrarian changes are dynamic process that usually leads to changes in policies and economy. Developments in Vietnam (including structural transformations, urbanization and rising income) loom large the livestock revolution, but also arise critical concerns about sustainable and inclusive agricultural and rural development. We use a political economy approach and historical international and national data to characterize the structural transformations and agrarian dynamics of Vietnam and its livestock sector.

The **Chapter 3, "Value chain and governance of dairy system in Vietnam"**, illustrates the sector and territorial dynamics by a case study of the dairy sector in one of the main typical milkshed in Vietnam that rallies the light over the dairy sector of the country. In this section, we examine how the transformation process played out in selected sector (dairy production) at a selected scale (territory and value chain), causing actors to emerge and support development, modifying the configuration of interest and the sector development. This focus on governance mechanism offers a new perspective on changes in trajectories of dairy farming and value chain in Vietnam. The local questions serve as basis for discussion at national level on the importance of sector governance in the economic, social and environmental transformations associated with livestock revolution and dairy boom.

The **Chapter 4** presents **Foresight scenarios for livestock transformation with a focus on dairy sector.** In the Vietnam in transition, family farming face a lot of challenges and threats for sustainable development (under the impact of intergratoin, urbanisation, industrialisation, and also the public policies towards large-scale industrial farms). However, the national statistics don't allow to produce knowledge about the performance of the dairy farms. Within the Revalter project, Khanh (2016) produced the diversifity of the dairy farms, so we moblize the perspective excersice to complimentarity the debates over the sustainability of the farms, dynamics a long terms. Rather than model building to predict future trends (Delgado et al. 1999), my assessment is based on

the analysis of past change and development up to the present and then work on participative scenario planning.

The last section devotes to **Discussion and Conclusion (Chapter 5)**. It is to open the debates over the development pathways for the dairy sector in Vietnam, taking into account limiting factors, i.e. land, labor and environmental externalities. The on-going restructuring of the agricultural sector (included livestock and dairy in particular) in Vietnam associated with processes of urbanization, industrialization, integration and driven by corporate interests. This restructuring is evident in both incremental and radical transitions in relation to scale, concentration, governance, sourcing strategies, and technology. These transitions have had and will continue to have important implications for rural livelihoods, poverty, food security, social justice and the environment.

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CHAPTER 2:

STRUCTURAL TRANSFOMATION, AGRICULTURE AND EMPLOYMENT IN VIETNAM

"It is the agricultural sector that the battle for long-term economic development will be won or lost"

Gunnar Myrdal, Nobel Laureate in Economic Sciences 1974

Structural Transformation, Agriculture and Employment in Vietnam

Mai-Huong Nguyen [(a)], Bruno Dorin [(b)], Guillaume Duteurtre [(c)]

[(a)] *RUDEC/ IPSARD, 16 Thuy Khue - Tay Ho - Hanoi - Vietnam. And CIRAD-MOISA, TAC9-15, 73 rue Jean-François Breton, 34398 Montpellier, France. maihuong.nguyen@ipsard.gov.vn*

[(b)] *CIRAD – CIRED, CHS Dehli, New Dehli, India. dorin@cirad.fr*

[(c)] *CIRAD, UMR SELMET, TA C DIR/C Campus International de Baillarguet, 34398 Montpellier, France. duteurtre@cirad.fr*

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Summary

Vietnam has exhibited rapid economic growth over thirty years of comprehensive economic reforms, but 50% of the country's population remain in rural and agricultural sectors. In order to characterize the role of livestock and agriculture in this transformation, we assess structural dynamics at different levels (country, agricultural sector and district territory) and their impact on sustainable development. The transition since *Doi Moi* (Renovation) has given rise to a political economy that provides incentives to industries and services, but also is increasingly interested in modern agriculture and large-scale farming. However, limited land availability and labor abundance have slowed ongoing structural transformations, widened income inequality and jeopardized sustainable and inclusive development. Smallholder farming and rural communities encounter many challenges to exploit resources efficiently and gain access to factor markets to achieve higher productivity and added value. To avoid the risk of falling into the middle-income trap, manage the livestock industrialization and pursue sustainable and inclusive development over the long run, deeper and wider reforms are needed based on smallholder viability and with an agro-ecological perspective.

Keywords: *Structural transformation, agriculture, labor, development trajectory, Vietnam.*

Résumé

Le Vietnam a connu une croissance économique rapide sur trente ans de réformes économiques, mais 50% de sa population reste dans les secteurs ruraux et agricoles. Afin de caractériser le rôle de l'élevage et de l'agriculture dans cette transformation, nous évaluons les dynamiques structurelles à différentes échelles (pays, secteur agricole et territoire de district) et leur impact sur le développement durable. La transition depuis le *Doi Moi* (Rénovation) a fait émerger une économie politique qui incite les industries et les services, mais s'intéresse aussi de plus en plus à l'agriculture moderne et à l'agriculture à grande échelle. Cependant, la disponibilité limitée des terres et l'abondance de la main-d'œuvre ont ralenti les transformations structurelles en cours, aggravé l'inégalité des revenus et compromis le développement durable et inclusif. Les petites exploitations agricoles et les communautés rurales rencontrent de nombreux défis pour exploiter efficacement les ressources et accéder aux marchés pour atteindre une productivité et une valeur ajoutée accrues. Pour éviter le risque de tomber dans le piège des revenus intermédiaires, gérer l'industrialisation de l'élevage et poursuivre un développement durable et inclusif à long terme, des réformes plus profondes sont nécessaires en fonction de la viabilité des petites exploitations et dans une perspective agro écologique.

Mots-clés*: Transformation structurelle, agriculture, emploi, trajectoire du développement, Vietnam*

1. Introduction

As a major economy of the Indochina peninsula, academics and donors have paid close attention to Vietnam and the political and socio-economic changes taking place there following the country's escape from prolonged wars and subsequent reforms (termed *Doi Moi*). The country has made great strides, thanks to advances in the rural and agricultural sector and poverty reduction (World Bank 2007): nearly half of the population has been lifted out of poverty in less than two decades (poverty headcount from 58% in 1993 to 16.7% in 2008 with poverty line at US$1.25); nutrition has been improved (undernourishment from 45.6% in 1990-1992 to barely 10% in 2012-2014); and the country is now qualified middle-income-country (MIC) (GDP at current US$ rose from under US$100 in 1986 to US$1907 in 2013). Agriculture now represents just 19% of GDP, but accounts for 47% of the national workforce and 59% of the rural labor force (GSO 2015), placing the country in the middle of a transition phase.

In Vietnam, as in many other Asian countries that have experienced the Green Revolution, livestock development is an important component of the current transition. We observe in particular the simultaneous presence of: (i) important land constraints linked to the concentration of human populations underlying land fragmentation and smallholder farming (Viswanathan et al. 2012), (ii) an increase in the consumption of animal products (milk in India, pork in China, milk and pork in Vietnam...) linked to population growth and rising living standards (Tisdell 2011; Briones and Felipe 2013). Growing demand for animal products dramatically intensifies the pressure on the land, since each calorie or protein consumed in these forms (milk, meat, eggs) requires an average of three times as much plant equivalent (cereals and oilseeds in particular).[6] The production of non-food biomass (fodders, pastures, crop residues) used to feed animals is also putting pressure on the land. This growth has multiple implications, notably in the following three dimensions: *(i)* the restructuring of the agricultural sector (composition of sub-sector, localization of agricultural workers and farm holdings, optimal farm size, etc.) in relation to non-agricultural sectors regarding resources endowment and capital allocation (land, labor, financial and social capital); *(ii)* international trade, particularly with a strong development of feed imports of Asian countries (mainly soybean and maize meal) from regions with much lower land pressure (FAO 2009a); *(iii)* degradation of local and global environmental goods: increasing consumption of water, fertilizers and

[6] Global average level in the 2000s (Le Cotty and Dorin 2012). This average level (3 to 1) varies among countries and tends to increase with time as industrial livestock farming, which has a huge demand for food (maize, soya meals, …) and non-food biomass (forage, fodder, …), increases.

pesticides to produce feed, overexploitation of land and/or cultivation of forests or pastures (two important carbon and biodiversity reservoirs), emissions (CH_4 and N_2O in particular) related to the production of animal feed and to breeding activity, and pollution of water and soils caused by geographical concentration of solid and liquid animal effluents (Steinfeld et al. 2010).

This dynamic acutely reflects the general trajectory of growth and structural transformation of Asian economies. Is Vietnam in particular following the classical structural transformation trajectory? Can Vietnam, a country with land constraints but labor abundance (Ravallion and Walle 2003; Markussen et al. 2016), follow the 'modern growth' pathways of industrialized countries that are now finding themselves in a "world without agriculture" (3% of GDP and 3% of the working population) (Timmer 2009) but experiencing income convergence between agricultural workers and non-agricultural workers (exit from rural poverty/poor rural)? Does specialization, industrialization, and motorization of crop and livestock production, like in developed economies, correlate with massive migration to cities (Dorin et al. 2013)? Regarding smallholder agriculture and livestock development, what are the technological and institutional innovations that are likely to sustainably support the role of agriculture and livestock in the structural transformation? These questions capture critical concerns about sustainable and inclusive agricultural and rural development. This paper contributes to the discussion on the structural transformation of Vietnam. It assesses those changes and their impact on sustainable development at three complementary scales: national, sectoral (agriculture and livestock) and local (district).

The first section captures macro-economic data at the national level in an aim to illustrate that Vietnam, as well as other Asian countries, is likely to fall into the "Lewis Trap", in contrast with industrialized countries that have embarked on the "Lewis Path" (Dorin et al. 2013). In the second section, we analyze this development trajectory in an institutional and historical perspective through periodized political economy of Vietnam since 1986, when radical economic reforms were initiated. Those 2 first sections are based on macro-economic indicators (GDP, population, employment, etc.) provided by FaoStat and national sources[7] as well as on literature review that allows to capture the policy and institutional framework. Comparative insights are also made by taking into account the facts and figures of structural transformation and agricultural transition of some neighboring countries. The third section focuses on the ongoing transformation within the

[7] Data sourced from General Statistics (GSO), including annual statistics, Agro Census (every 5 years since 2006), Vietnam Household Living Standard Survey (every 2 years since 2000)

agricultural sector, especially the place of the livestock sector in the transformation process. Important changes have happened within agriculture itself with the emergence of the livestock sector due to the higher income elasticity of demand for livestock (Tisdell 2011). It is believed that larger and more specialized farms would increase food supplies to reduce the imports dependency. However, agricultural land limits, impediments to rural-urban migration, and a labor exodus from agriculture to non-agriculture sectors raise economic, social and environmental questions regarding the sustainability of development based on large and increasingly specialized farms (Tisdell 2011). This issue should be debated among policy-makers. The last section illustrates those global dynamics with a case-study. We present the development of the milk production in Ba Vi, a district located in the Hanoi capital region, and the way it has been affected by the structural transformation. This local case-study allows us to confirm the macro-economic and sectoral development pathways. It also underlines some of the risks related to the current changes regarding rural employment, social equity and environmental changes.

2. The canonical path of structural transformation and Vietnam

Structural transformations (Chenery and Srinivasan 1988) are notably characterized by the decline of the agriculture sector's share in total output, GDP and employment, moving to a greater emphasis on industries and services in national economies (Timmer 1988,1992; Barghouti et al. 1990; Briones and Felipe 2013). Anchored on the 'dual economy model' (Lewis 1954) and 'modern economic growth' (Kuznets 1966), transformation occurs through the "push" of low income of the "traditional" sector (agriculture) and/or the "pull" of higher wages and incomes in "modern" sectors (industry and services). After the Green Revolution era, agriculture was underestimated as a key contributor to structural transformation (De Janvry 2010). Even in Asian countries, where the agricultural population[8] accounts for nearly half of the total regional population (FAO 2014), the structural transformations since the 1980s are always considered to be driven by manufacturing or service sectors. In the wake of the subsequent financial crisis in Asia (1997) and the global food crisis (2008), the role of agriculture as a "development driver" (FAO 2009b), primordially underlined by the Physiocrat (Quesnay) and Classical (Ricardo) schools, has returned to the scientific and policy agenda. Agriculture for development should be reconsidered based on the food security, a search for new technical and institutional models accompanying the development of family farming

[8] Agricultural population is defined as individuals dependent on agriculture, hunting, fishing and forestry for their livelihood

(World Bank 2007), sustaining smallholder dynamism (Viswanathan et al. 2012) and connecting the poor to the growth process (Timmer 2009).

There is extensive literature on the structural changes and agricultural transformation of developing Asian economies. Accordingly, a deeper understanding of change patterns may be found in different factors shaping the sector: land availability and farm size (Ravallion and Walle 2003; Kirk and Tuan 2009; Thapa 2009; Viswanathan et al. 2012; Dawe 2015), income and diversification (proxied by productivity gap[9]) (Timmer 1992; Lin 2011; Dorin, et al. 2013; Dawe 2015), employment (active population, migration, family and/or hired labor) (McMillan and Rodrik 2011; Viswanathan et al. 2012; Narciso 2015). In addition to these fundamentals of development, there are underlying drivers: policy and institutional environment, technology progress, global value chain (GCV), climate change, etc. (AIT 2010; Tisdell 2010; Viswanathan et al. 2012; Reardon and Timmer 2014; Abbott et al. 2017).

While Western economies experienced a rapid and complete transition from agricultural to advanced capitalist or industrial societies (Timmer 2009; Dorin et al 2013), the process of transformation has been slow in most of Asia, barring a few countries (Viswanathan et al. 2012; Briones and Felipe 2013). In developing Asia, structural transformation is still characterized by a faster decline in the share of agriculture in total output than in employment (

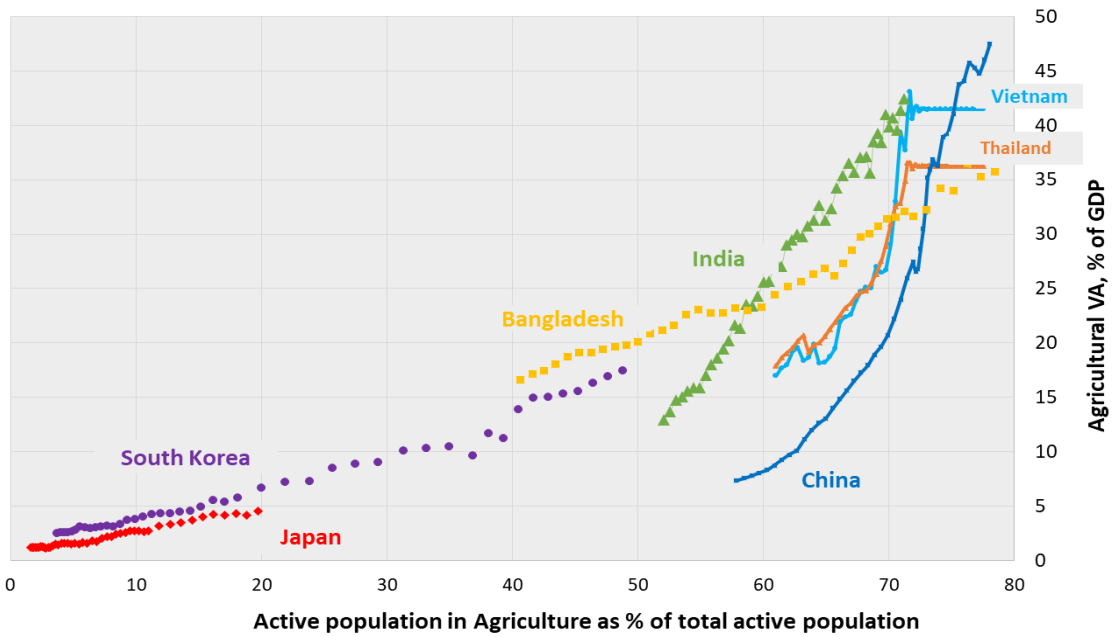
Figure 2.1). A drop in surplus labor is explained by the lag in the speed of decline between employment and output shares. High population growth rates heighten the labor absorption issue, leading to a failure in reaching the *Lewis* '*turning point*'[10] (ADB 2013). Accordingly, developing Asian countries fall into the "Lewis Trap" (Dorin et al. 2013), an alternative to the "Lewis Path" which drives economies to "a world without agriculture"[11] (Timmer 2009).

[9] Timmer (2009) underlined '*the basic cause and effect of the structural transformation is rising productivity of agricultural labor. There are three ways to raise labor productivity in agriculture (and the first two are usually linked): use of new technology to produce more output for a given amount of labor (an agricultural revolution); (2) let agricultural workers migrate to other occupations, without lowering output, thus sharing the output with fewer rural people (the classic Lewis model of development, leading to an industrial revolution); (3) Through higher prices for agricultural output (make it work more in real economic terms, which may well be happening in the current economic era, but is a reversal of historical trends – this would be a price revolution based on scarcity rather than surplus)*

[10] The Lewis 'turning point' is defined as the point at which a labor surplus in the agriculture sector shifts to a labor shortage reflected in increasing agriculture wages.

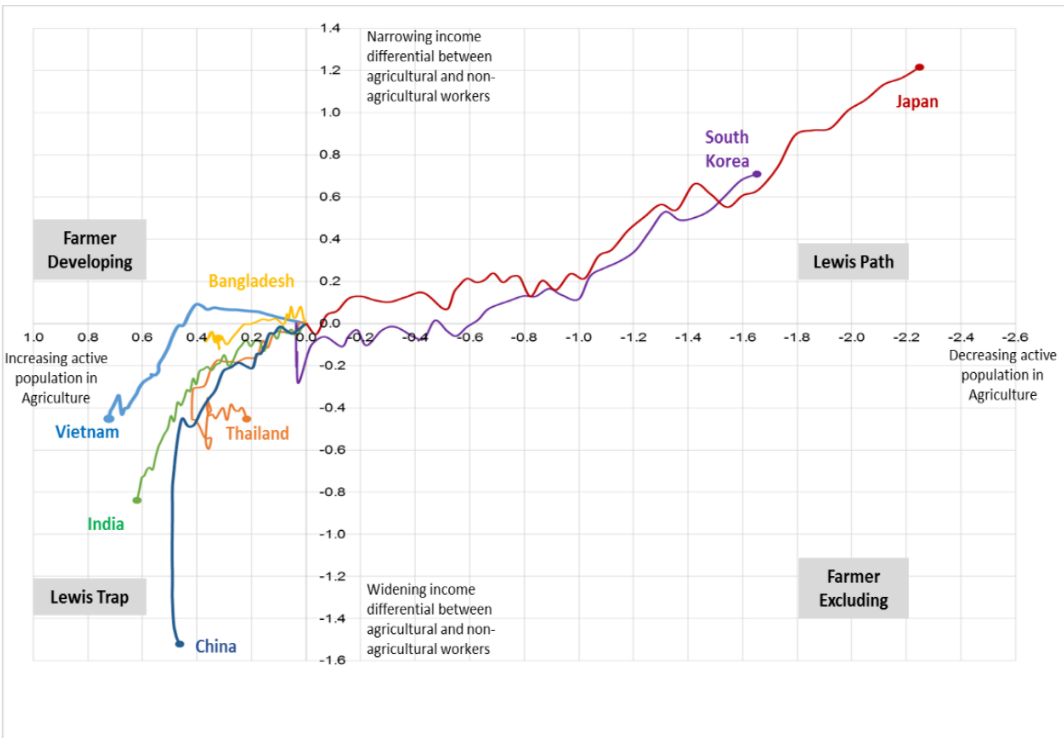
[11] "A world without agriculture" refers to the share of agriculture in labor and GDP declining and converging to the level of 2-3% (Larson and Mundlak 1997)

Figure 2.1: Share of agriculture in GDP and employment (1970-2015)



The dynamics of countries from 1970 to 2015 move from right to left. Data source: Economically active population are retrieved from Faostat (2014); Value added in 2005 USD by broad sectors are consolidated from UNSTAT (2015).

Figure 2.2: Dynamics of structural transformation in Asian countries (1970 – 2015)



The figure shows the cumulative growth rate (1970=0) of: (i) the growth of the active agricultural population (X-axis); (ii) the income gap between agricultural and non-agricultural workers (Y-axis). Population data are retrieved in series from 1970 to 2014 from Faostat (2014). Value added in 2005 USD by broad sectors are consolidated from UNSTAT (2015). Computation follows model of Dorin et al. (2013), Dorin and Aubron (2015),

Table 2.1: Structural transformation in Asian countries (1970/1971-2014/2015)

Country	Population (people)	Economic growth (2005-USD)		Workforce (workers)		Labor productivity (2005-USD)		Farm-nonfarm income convergence (LIR)
		Total	Agriculture	Total	Agriculture	Total	Agriculture	
Bangladesh	+2.04%	+4.29%	+2.46%	+2.32%	+0.72%	+1.93%	+1.75%	-0.15%
China	+1.16%	+8.52%	+4.10%	+1.70%	+1.03%	+6.72%	+3.05%	-3.38%
India	+1.93%	+5.41%	+2.77%	+2.09%	+1.38%	+3.25%	+1.38%	-1.86%
Japan	+0.44%	+2.53%	-0.40%	+0.39%	-5.00%	+2.13%	+4.85%	+2.70%
South Korea	+1.01%	+6.70%	+2.32%	+1.97%	-3.67%	+4.63%	+6.25%	+1.54%
Thailand	+1.37%	+5.71%	+3.21%	+1.79%	+0.49%	+3.86%	+2.72%	-0.98%
Vietnam	+1.71%	+5.83%	+4.15%	+2.15%	+1.60%	+3.60%	+2.50%	-1.01%

Annual growth rate computed from FAOStat data and Bruisma (2009)

The trajectories of structural transformation have been quite distinct in Asia (Figure 2.2, Table 2.1). While newly industrialized economies in East Asia (Japan, South Korea) followed an agriculture development-led industrialization pathway, the middle-income Asian economies (China, India, Thailand and Vietnam) seem to be similar to each other (Tisdell 2011; Briones and Felipe 2013). Vietnam and China share many traits with each other having initiated their economic reforms[12] from the agricultural sector with the restoration of individual and private economic incentives to replace a collective system. However, China has experienced a more rapid structural transformation through rural industrialization supported by town-and-village enterprises, huge capital accumulation, generated mostly by non-agricultural sectors, and a faster decrease in agricultural value-added share. Vietnam and India have followed an identical path of "discharging" (Sauvy 1981) labor from agriculture to other sectors, but the income gap between sectors in former country is shrinking more slowly than the later. Compared to Vietnam, Thailand is marked by a fluctuation in income gaps between farm and nonfarm sectors as well as the rate of labor withdrawal out of agriculture. The structural dynamics of Thailand have been disturbed by political instability and high exposure to regional and global crises, which have contextualized the mash-up of pro-agricultural policies and agricultural neglecting options over the years. In recent years, Thailand is likely to embark on Lewis Path while income disparity is not widened despite decreasing agricultural active population.

Zooming in on Vietnam's trajectory, antipodal to the Lewis Path in Figure 2.3 and Table 2.2, we observe two clear-cut phases characterized by the productivity difference between agricultural and non-agricultural sectors. Incentives at the early stage of reforms

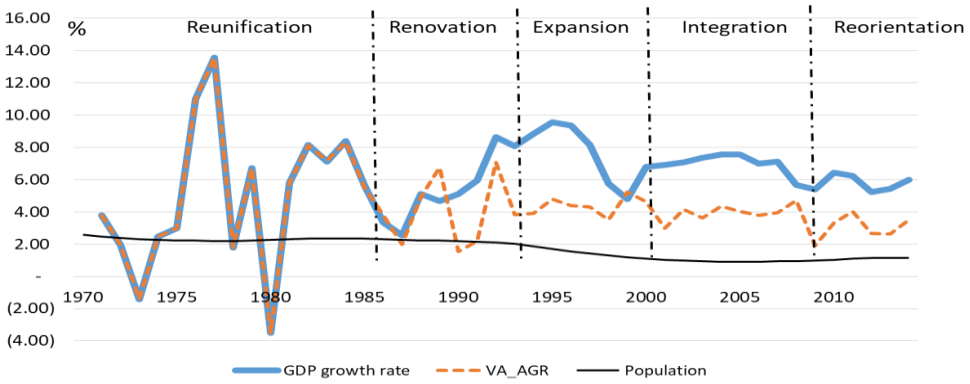
[12] China's economic reforms began in 1979; Vietnam's economic reforms began in 1986.

(since 1986) brought an ad-hoc positive impact on narrowing the income division between sectors. Yet since the early 1990s, with the deepening adjustments and speeding-up of economic liberalization and integration, the growth of the active agricultural population has slowed down, while labor productivity has become more divergent among sectors.

3. Political economy of a country in transition

Thirty years after the launch of economic reforms, known as *Doi Moi* (1986), Vietnam has made striking progress among developing Asian countries in moving from the "*beginning*" stage to the "*early integration*" stage (Briones and Felipe 2013) of the four phases of agricultural transformation defined by Timmer (1988) [13]. Vietnam has experienced sustained economic growth of between 5% and 6% on average, with exceptional falls during the regional financial crisis in 1999 and global economic downturn in 2008. This section provides an analytical lens and a historical perspective of political economy of development to understand the drivers, causes and effects of structural changes and the agricultural transformation process. From a rural and agricultural perspective, our review spans 5 periods in line with segments analyzed by OECD (2015) and World Bank (2016). Those sequences refer to major changes in the national policy context, but also to some events that happened in the regional and global environment. State interventions and policy choices (see *Appendix 3*) have significantly influenced agricultural transformations and structural dynamics. Figure 2.3, Figure 2.4, Figure 2.5, Figure 2.6 and Table 2.2, Table 2.3 show the evolution of basic macro-economic and demographic indicators during those periods.

Figure 2.3: Economic and demographic growth rate (1970/1971-2014/2015)



Source: FAOStat 2015. GDP in USD-2005.

[13] At the *beginning phase* (1st stage), agricultural labor productivity starts to increase. As soon as the productivity reaches a sufficiently high level, the country enters the *agricultural-surplus phase* (2nd stage) which facilitates the growth of agricultural sectors with labor, savings, and tax revenues coming from agriculture. The country then jumps into the *integration phase* (3rd stage) in which non-agricultural sectors grow and the agricultural sector is linked to the rest of economy through improved infrastructure and markets. Upon the successful integration of sectors, the country reaches the *industrialized phase* (4th stage)

Table 2.2: Economic and demographic growth rate (1970/1971-2014/2015)

Period	Population	GDP per capita	GDP	GDP_{Arg}	GDP/ GDP_{Arg}	Active population in Agriculture	Agricultural Productivity	LIR
1970 - 1985	+2.16%	+2.65%	+4.87%	+4.86%	3.29	+2.09%	+2.72%	+0.48%
1986 – 1993	+2.09%	+3.50%	+5.71%	+4.02%	3.40	+2.13%	+1.86%	-1.90%
1993 – 2000	+1.54%	+5.75%	+7.38%	+4.49%	4.27	+0.98%	+3.47%	-2.27%
2000 – 2008	+1.14%	+5.83%	+7.04%	+4.09%	5.24	+1.04%	+3.02%	-1.86%
2008 – 2015	+1.07%	+4.87%	+6.00%	+2.68%	6.55	+0.78%	+1.89%	+0.16%

Source: GSO, 2015; FAOStat 2015. GDP in USD-2005.

Table 2.3: Share of economic sector in the GDP (1986 – 2014)

Period	Agriculture	Industry	Service
1986 – 1993	38.75%	25.85%	35.40%
1993 – 2000	26.01%	31.52%	42.47%
2000 – 2008	20.10%	37.20%	42.70%
2008 – 2015	18.57%	35.15%	40.77%

Source: GSO 2015; FAOStat 2015. GDP in USD-2005.

Figure 2.4: Active population in Vietnam (1970 – 2015)

Source:
- *Total population: 1970 – 2015 from FaoStat 2015*
- *Total active population and Agricultural active population: 1970 – 2004 from FaoStat 2015*
- *Total active population and Agricultural active population: 2005 – 2015 from GSO 2015*

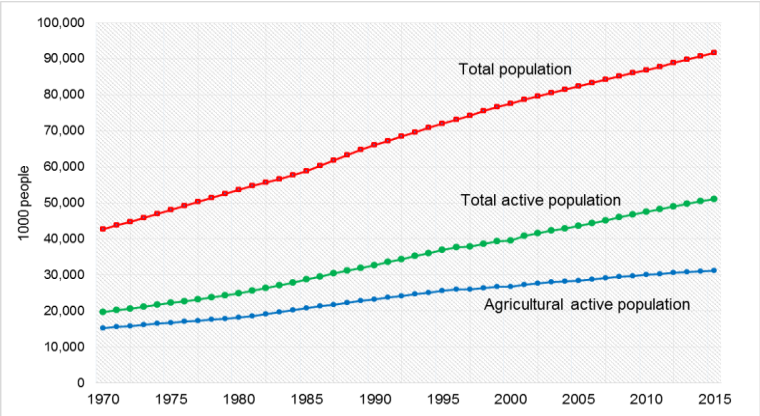
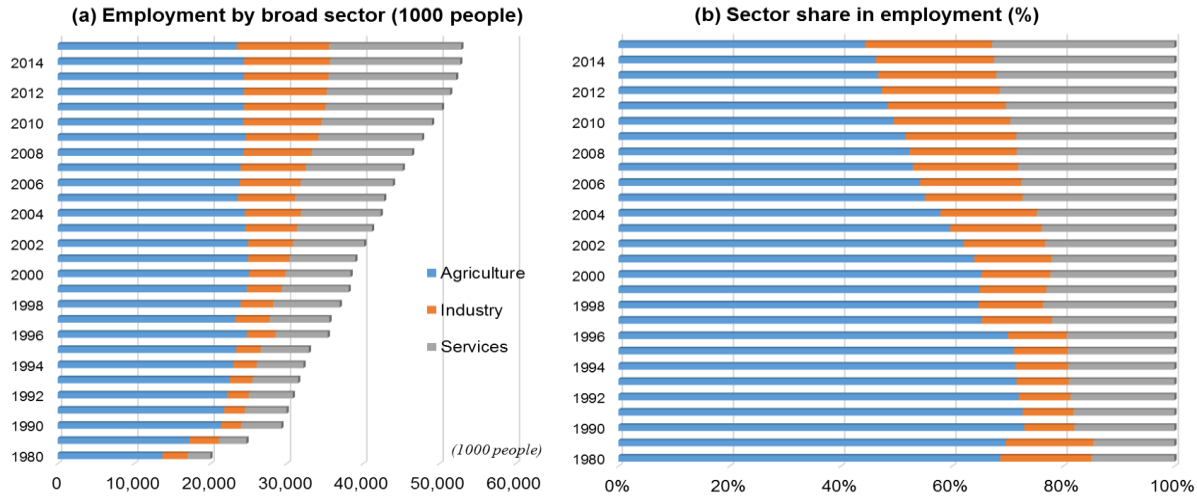


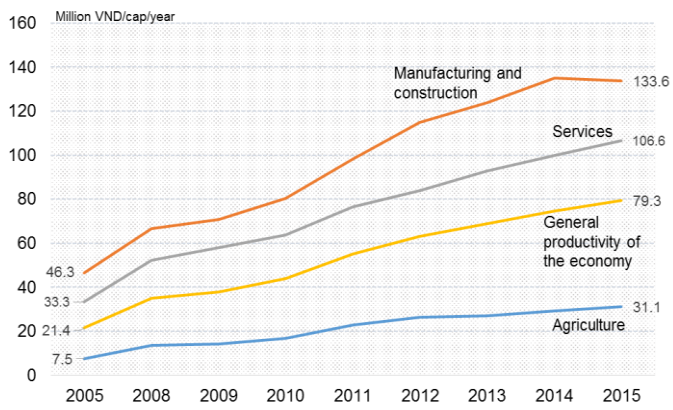
Figure 2.5: Employment by broad sector (1980 – 2015)



Source: GSO, 2015

Figure 2.6: Labor productivity by sector (2005 – 2015)

Source: Data of GSO. Calculated by dividing GDP (current price) by total employment by sector (from 15 years old)



3.1. Vietnam on the Eve of Doi Moi (Reunification, 1970 – 1986)

Prolonged wars put Vietnam into a situation of severe hardship. After Reunification (April 1975), the predominately agrarian country fell into a post-war crisis characterized by a stagnant central planning system, slower economic growth, weak collective production on state farms and cooperatives,[14] cuts in external aid,[15] and conflicts with neighboring countries (Cambodia and China) in the late 1970s. The "impasse of the collectivist regime" (Gironde 2004) resulted a severe food deficit by the end of the 1970s and early 1980s. From an economic perspective, pilot contractual incentives to release production resources to households were tested in some localities as a remedy for overcoming chronic food access problems.[16] The emergence of such contracts can be interpreted as an experimental phase of market-style reforms which were still debated among policy makers (Que 1998).

Directive 100-CT/TW (13th January 1981, known as *Contract 100*) triggered agricultural reforms in Vietnam with the introduction of the 'end-production contract' (*khoán sản phẩm*) aiming at empowering farm households (individual or group). Farmers were assigned land under a 3-year contract for farming. After harvests, farmers delivered an output quota[17] to cooperatives and any surplus could be sold on the free market. This new incentive encouraged farmers to increase investment in their land and brought a rise

[14] In 1980, there were 126,056 cooperatives across the country, covering 66% of the active population in agriculture. Cooperatives managed and used 95% of the cultivated land, but only generated 50% income for their members after fulfilling obligations and contributions to the State.

[15] USA put an embargo on trade and investment in 1978; China ended their aid in 1979.

[16] A pilot production contract was tested in a cooperative in Do Son district (Hai Phong) in 1978-1979. Under the contract system, households were allocated land for cultivating rice. After having fulfiled their quota obligations to the cooperative, households could retain the surplus on farm. Positive results encouraged Hai Phong authorities to scale up the new production scheme to all agricultural cooperatives in the provinces in the early 1980s.

[17] The output quota was defined on the basis of land productivity over the previous 3 years. In reality, these quotas were subject to be adjusted and increased by cooperatives upon actual output gains.

in agriculture (Figure 2.3): agricultural grew by 7.8% during the 1981-1984 period. However, the centrally-planned economy did not provide adequate institutional innovations to promote the *Contract 100* mechanism (production resources remained under the management of cooperatives, no legal base for the transfer of land from cooperatives to households, strict state control over input and output pricing, insufficient provision of intermediate inputs, deteriorating terms of trade, relatively high agricultural tax[18]). The economy was then crippled by a scarcity of staples and consumer goods, impoverished living conditions, industrial stagnation, and mounting foreign debt (Chinh and Quan 2009; Quan et al. 2011). The dual pricing system[19] resulted in hyperinflation by the mid-1980s: 92% in 1985 and 774% in 1986. Radical price increases, wage readjustment and the monetary exchange exercise in 1985 added to economic hardship and paralyzed the country (Kirk and Tuan 2009).

3.2. Vietnam at the onset of Doi Moi (Renovation: 1986 – 1993)

"Fence-breaking" experiments in the early 1980s inspired subsequent political and economic reforms starting in the mid-1980s. The Sixth Congress of the Communist Party (December 1986) announced economic reforms, named *Doi Moi* (*Renovation*), enabling Vietnam to transform from a centrally planned to a market-based economy based on an export-growth strategy accompanied by sweeping changes (Xuan and Xing 2008; Brand-Weiner et al. 2015). Three economic corrective packages were emphasized: elimination of the central management system by adopting a market-driven economy involving different stakeholders and different types of ownership; economic management reforms; and altering the approach to industrialization by shifting from heavy industry towards the production of food and foodstuffs, and consumer and export goods. Early in the reform process, natural calamities (huge flood in the Red River system in 1986; cold winter and sunless spring in 1987) added to the fragility of agriculture. Successive poor harvests resulted to food shortfalls of nearly 1.5 million tons and severe famine, hitting 21 provinces and cities in the North in March 1988. With 3.6 million people near starvation, agriculture faced a new crisis (Que 1998) that, together with the erosion of state institutions (Kirk and Tuan 2009), called for stronger corrective measures and radical reforms.

[18] Agricultural taxes on production output was: 6-14% for paddy, 10-30% for fruits crops, 12% for perennial crops (Barker et al. 2004).

[19] The dual price system refers to the official business prices (set by the government) and free market prices. The official prices were fixed and much lower than the market prices, leading to speculation and smuggling in the context of a scarcity of goods. Goods were diverted from fixed-price central planning channels to the free market where they were traded at higher prices. The gap between official prices and market prices were 10 times or more.

The most important policy breakthrough was the Politburo's Resolution 10 (known as *Contract 10*) on reforming the management of the agricultural economy[20] through decollectivization. Contract 10 offered a 'package contract' (*khoán gọn*) to peasant households and formally stated certain rights underpinning the economic role of households. Farming households are considered as the basic independent economic unit in agriculture. The key feature of Resolution 10 involved the formalization of extended land use rights (LUR), which was clearly a change from past Directives (see *Appendix 4*). Besides longer land tenure (15 years for annual crops, 40 years for perennial crops) with tacit renewal as a form of security, farmers were granted greater production rights (investment, production, and marketing), while cooperatives were given the responsibility of only input and service provision (irrigation, plant protection). The agricultural production tax was adjusted to 10% for all annual crops in January 1989.

The removal of compulsory public output procurement, the abolishment of the ration system, the price liberalization in March 1989 (freed up prices of goods, interest rates and foreign exchanges) and the formation of a two-tiered banking system[21] in May 1990 contributed to improving the macro-economy and curbing inflation: for the first time, there was a positive interest rate, higher savings deposits, an increased supply of goods, and excess liquidity. Theoretically, farmers can access credit provided by the state commercial banks (VBARD or BSP).[22]

The better performance of the economy in this period was attributed to the dramatic turnaround of the agriculture sector, especially in rice production. Cropping surfaces increased, especially in the Mekong River Delta (MRD), thanks to an improved irrigation system[23] and widespread application of Green Revolution technologies (seeds, fertilizers, high-yielding varieties) which were largely subsidized by the government. From a net importer of rice, Vietnam catapulted to being the world's third leading rice exporter in 1989 (approximately 1.5 million tons, following the United States and Thailand). At the micro level, higher returns encouraged farmers to invest further in consumer goods and upgrade their farming equipment. At the macro level, more capital savings and an improved trade balance fuelled further structural transformation of the economy in the periods that followed.

[20] Resolution 10-NQ/TW was adopted in April 1988 to replace Directive 100

[21] Under the central bank (State Bank of Vietnam – SBV), there are a number of financial institutions (state-owned commercial banks, joint-stock banks, joint-venture banks, subsidiaries of foreign banks, credit cooperatives, people's credit funds).

[22] VBARD: Vietnam Bank for Agriculture and Rural Development (Agribank); BSP: Bank for Social Policies

[23] The construction of irrigation system in Mekong River Delta enabled farmers to make use of idle land and plant two rice crops per year.

3.3. Wider reforms in practice (Expansion: 1993 – 2000)

During this period, Vietnam accelerated the building of market institutions in all sectors to break the State monopolies and to favor a more market-oriented environment. The 1993 Land Law lengthened land tenure (20 years for annual crops, 50 years for perennial crops), and adopted legal land titles, and enabled non-market transmission of land use rights (inheritance, transfer, exchange, lease, and mortgage). However, the egalitarian nature of land distribution (by land quality, by number of household members registered, irrigation system, and capacity of crop rotation) remained and led to high land fragmentation[24] and scattered farmland, especially in the Northern provinces. In the densely populated Red River Delta, the average farm size was 0.23ha, one-fourth of the size (1.1ha) cultivated by peasants in the Mekong River Delta (MRD) (GSO 1995). Such tacit land distribution also led to an increasing agricultural population and high opportunity costs of agricultural land due to the absence of functioning rental markets.

The status of cooperatives was legally redefined as service providers (irrigation, plant protection, extension services, input supplier, credit provision and output marketing) (Cooperative Law 1996). From there, continued efforts to reform the cooperative system have been observed. The reform agenda also included incentives and policies calling for investments, technological innovations and institutional reforms aiming at improved rural production efficiency and improved cost-effectiveness performance.[25] As a result, agriculture grew 4.5% annually, contributing to the 7% growth of GDP (Table 2.2). Agricultural productivity rose substantially thanks to intensified rice production and diversification into higher added value crops for export (coffee, rubber, and aquaculture). Household land use rights (LUR) and the liberalization of fertilizer imports encouraged the adoption of improved varieties with widespread integrated pest management (IPM) and increased application of fertilizers: between 1990 and 1999, applications of fertilizer tripled from 83kg to 250kg per hectare of agricultural land (Figure 2.13 in *Appendix 5*). Most of these significant increases in agricultural crops[26] continued to be due to improved irrigation systems (dikes in MRD, rehabilitation of irrigation system in the RRD, private

[24] According to the Agricultural Census 1994 (GSO), average farm size is 0.49 ha, with an average of 0.3 ha for annual crops and 0.06ha for perennial crops.

[25] Decree 12/1993/ND-CP on reforming organization and management of state agricultural enterprises(02nd March 1993); Decree 13/1993/ND-CP on agricultural extension (2nd March1993), Decree 14/1993/ND- CP (2nd March 1993) on credit for extended agriculture and rural development; Law on tax on agricultural land (1993);

[26] Average yield of cereals per hectare from 1990 to 1994 was 3.2 tons (paddy equivalent), rising to 3.8 tons and 4.4 tons for periods of 1995-1998 and 2000-2004 respectively.

investment in pumps in uplands) that expanded the total irrigated area (Figure 2.12 in *Appendix 5*).

Despite the agricultural sector's improved performance, industry protection interventions (in favor of capital-intensive industry and state-owned enterprises (SOEs)) burdened agriculture and exacerbated the income gap between farm and nonfarm sectors. Protected industries (such as the heavily-subsidized sugar sector) moved the terms of trade against agriculture and hindered the ability of non-protected industries to absorb the labor surplus from agriculture. Tax and fee duties[27] weakened the low income of farmers and slowed their productivity. The relative annual tax burden was estimated to be around 24% of the agricultural output (Barker et al. 2004).

The country was more open to the world: the U.S embargo on Vietnam was totally lifted (1994), the normalization of the relationship between the U.S and Vietnam was announced (1995), the country joined ASEAN as an official member (1995), became involved in AFTA (1996), joined APEC (1998). On one hand, an increasing presence on international markets has enabled deeper reforms and brought about new market opportunities for products (especially agricultural products), on the other hand, it has made farmers more exposed to international price instability. As a young market, Vietnam was not much hurt by the regional financial crisis during 1997-1998, but GDP growth was declining (4.77% in 1998-1999) and the expansion of industries was put on standby.

3.4. Integration into regional and global economy (Integration: 2000 – 2008)

The country was back on track after the Asian financial crisis with reform efforts focusing on SOEs,[28] the financial sector and the development of factor markets.[29] Integration into the regional and global economy was accelerated by further opening: accession to WTO (2007), negotiations on bilateral and multilateral trade agreements.[30] This deeper integration involved fulfilling international trade commitments (eliminating export subsidies, improved hygiene and quality standards, laws on intellectual property rights, lower tariffs, reduced import duty rebates, demanding technical barriers…) that have

[27] Including land-based tax (land classified into six classes base on relative conditions of land: quality, location, terrain, and conditions of irrigation and drainage), water use fees, and other local fees levied by provincial, district and commune authorities.

[28] Reforms of SOEs embraced 4 key measures: (i) reform of SOE management; (ii) reorganizing and reinforcing state owned general corporations; (iii) SOE equitization; and (iv) transferring, contracting, leasing and selling of SOEs.

[29] The Ho Chi Minh Stock Exchange and the Ha Noi Stock Exchange (formerly Security Trading Centers) inaugurated in 2000 and 2005 respectively have upheld the capital accumulation and investments

[30] ASEAN-China FTA (2004), ASEAN-Korea FTA (2006), ASEAN-Japan FTA (2008), and Vietnam-Japan EPA (2008)

impacted the structural changes of the economy and particular sectors, especially agriculture. In 2000, the government phased out the agricultural tax, which was a burden on farmers and limited agriculture's contribution to national wealth (Son et al. 2006). Rice export quotas and fertilizer import quotas were then discarded (2001), enabling local firms to engage in international trade. Amendments of the Land Law (2001, 2003) enhanced agricultural market-based growth by allowing foreign investors to acquire LUR and promoting land consolidation in agriculture. Farmland fragmentation (average 4.3 plots per rural household in 2004) has reduced the size of operational holdings, hindering the economies of scale and mechanization. In addition to the additional investments in agricultural infrastructures (roads, irrigation…), facilitated land exchanges and rentals[31] have enabled farmers to have larger areas of more continuous plots to cultivate. Moreover, because land can be transferred to more efficient producers, farmers have diversified their production into aquaculture, livestock breeding, and investments in trees and shrub crops.

The pace of rural transformations speeded up with various investment patterns and incentives[32]: downsizing public investment in agriculture[33], reducing and restructuring SOEs[34] operating in agriculture, supporting private investment in the rural sector (between 2000 and 2008, number of agricultural enterprises tripled, from 3378 to 8691 enterprises), and promotion of contract farming (Decree 80, 2002). In 2008, public investment in agriculture contributed to support partly the private sector (56% of total public investment), SOEs (34%), and foreign investors (10%).

Economic development was dedicated to the emergence of industry and manufacturing (10% per annum) and surges in Foreign Direct Investment (FDI) inflows (US$ 9.6 billion in 2008, 55% of the export values produced by the FDI sector (Athurokala and Tien 2012). FDI in agriculture went into agro-processing projects (54% of the total registered capital), forestry production and forestry processing (25% of capital), and livestock and animal feed (13%). The dominating role of FDI enterprises in the manufacturing sector did not result in greater social mobility. Despite the dwindling share of agriculture in total

[31] Land rental incentives allows owners of agricultural land without comparative advantages in farming activities (farming endowments such as human, capital…) provide land rentals and join the nonfarm sector where they can earn more.
[32] A number of National Target Programs (NTPs) were initiated and involved different stakeholders (Government, donor agencies, private sector): NTP on Hunger Eradication and Poverty Reduction, NTP on employment creation, NTP on five-million hectare of forest, NTP on rural water and sanitation.
[33] From 12.2% 2000 to 8.5% in 2004 (MARD 2004). Share of state agricultural investment just accounted for 3.9% of state budget (2010), lower than other countries: Public investment in agriculture over state budget expenditure: Thailand: 5.8%, Philippines: 5.9%; Malaysia: 6.7%; China: 9%; Myanmar: 8% (OECD 2015).
[34] Between 2000 and 2008, the number of SOEs operating in agriculture was reduced by half

employment, we still saw an increase in absolute terms of the contribution of agriculture to total employment (Figure 2.5). The industrial sector is not very resilient to adverse global trends: 67,000 workers in enterprises lost their jobs and real wages declined in the wake of global economic downturn (2007-2008) (Quynh 2009). The slower GDP growth in 2007-2008, at 5.6%, brought greater reductions in manufacturing and construction than in agriculture (Abbott et al. 2015). Agricultural was continuing to grow by around 4% per year, despite a negative external environment of low commodity prices on the world markets.

3.5. Restructuring and adjusting in the motion (Reorientation: since 2008)

Structural transformation has continued to sustain economic growth, which has averaged 6% over the last 6 years (2009-2015), but at the expense of increasing income inequality (GINI coefficient rose from 34.7% in 1992 to 38.7% in 2012). During this period, the structural transformation process has slowed (Figure 2.3), despite the "demographic window"[35] which opened in 2010 is expected to be an opportunity for accelerating development due to a young labor force and lower wages (Chung and Dang 2012). The marginal gains of agriculture have become less important: sector share of national employment has dropped by 5% (Figure 2.5); agricultural productivity growth has slowed and has fallen behind industry and service (Figure 2.6). The speed and magnitude of these relative shifts have not been translated into absolute labor mobility from farm to nonfarm sectors. Nonfarm sectors are not mature enough to absorb all of the labor surplus from agriculture. Furthermore, rural people have not all been drawn to the cities in search of more remunerative employment opportunities in nonfarm sectors due to certain socio-cultural elements: the permanent household registration system (*"hộ khẩu"*) impedes labor relocalization due to limited access to full welfare packages and public services in urban areas; the limited professional skills of the active rural population obstructs their job opportunities in industry and services (Figure 2.14 in *Appendix 5*); farmland in the village is regarded as a form of security in the event of a crisis. A number of rural households therefore continue to cultivate their land for a living in addition to increasing their income from secondary and tertiary sources (nonfarm activities within the local area locality, migration to the cities or abroad). By 2012, agriculture contributed less than 50% to the total income of more than half of rural households (GSO 2013). Within

[35] "Demographic window" refers to an optimal population structure, in which a large group of working-age people supports relatively fewer older and younger dependents (UNFPA 2002). The demographic window, which opens once when the dependency ratio is under 50%, offers a unique opportunity for countries to invest in economic growth. The 'demographic window' is forecasted to be opened to Vietnam for 30 years (Chung and Dang 2012)

agriculture, small farm size and limited access to credit (mostly due to the absence of LUR certificates) have handicapped farmers from expanding and diversifying their production to improve productivity.

With regard to the investment portfolio in agriculture, private investment outpaced public investment (64% versus 34% of total investment in 2010). The decline in public investment is offset by an increase in credit provided to famers through credit programs for agriculture and rural development (ARD).[36] FDI projects in agriculture,[37] accounting for 14.7% of the total FDI inflows during the 2000-2013 periods, brought earnings of US$ 312 million, of which US$ 100 million from exports (OECD 2015). The high prices of agricultural products during 2007-2008 emphasized the role of agriculture as a buffer during less prosperous time. The growth of agriculture is a resource that maintained overall employment roughly constant while industry and manufacturing generated slower employment growth. The question of how to sustain agricultural growth in coming periods is coming sharply into focus. Major drivers for the increase in total agricultural output over the past 30 years have been institutional changes and increased input usage. Additions to land, labor, fertilizer and irrigation have been the primary causes and now appear to be reaching their limits for generating more growth. Resolution 26 (2008) called for concrete efforts to promote the parallel development of agriculture, rural areas and farmers in the long run. The Agricultural Restructuring Plan (ARP) was adopted in 2014 and aims for improved value added and sustainable development. The country's agricultural modernization aspirations have been ecologically repackaged (Fortier 2010; Fortier and Trang 2013) as Vietnam is ranked among the five countries most affected by climate change (ADB 2009).

Vietnam is now at the middle-income stage (Briones and Felipe 2013). Being a land-constrained country, Vietnam is challenged by the raising land productivity to generate higher wealth in view of speeding up its structural transformation. Upon constraints and trade-offs, diversification and intensification strategy are opted for raising agricultural productivity in response to growing risks and uncertainties associated to food systems and contributing to poverty reduction. Since scope for expanding agricultural land is limited, higher yields can be generated from different crops and keeping livestock for

[36] Decision 497 (17 April 2009) of the Prime Minister provided a state fund of US$ 1 billion to support farm households in purchase of intermediate inputs and machinery.

[37] Between 2000 and 2013, there were 512 FDI projects in agriculture with 3.3 billion USD of registered capital. FDI in agriculture are rooted in 50 countries, mostly Taiwan, Japan, China, Thailand (60%) (Quang and Ngoc 2011; OECD 2015).

higher yield and profit per hectare. The next section will zoom the structural transformation in on properties of agricultural transition and livestock dynamics.

4. Agricultural transformation and livestock revolution

Compared to its neighbors, Vietnam has enjoyed relatively stable growth in the agriculture sector since the launching of *Doi Moi* (Figure 2.11 in *Appendix 5*). The structural transformation has been underpinned by the agricultural transformation itself. This section highlights the changes within the agriculture sector with its sub-sector composition, emergence of commercial farms, and dynamics of agricultural value chains.

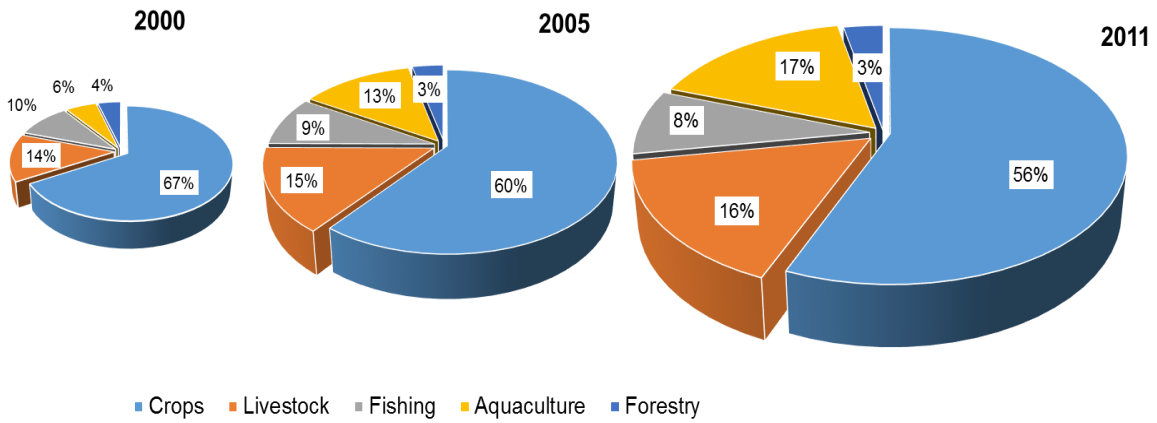
4.1. Composition of agriculture

Rural and agricultural policies since *Doi Moi* have shed light on the government's priorities towards valorizing "Green Revolution" endeavors, increasing the productivity and quality of agricultural production that is limited by a shortage of productive land. Changes in land policies (decollectivization, land title, land tenure, etc.) have encouraged diversification from rice production to other crops (perennial, aquaculture) in order to reach higher income per hectare. Agricultural output has shifted dramatically from traditional to high-value market products (pepper, coffee, catfish and shrimps, etc…), albeit with the increasing regional and international trade (Figure 2.7). The continued growth in agriculture is fuelled by not only increasing yields for traditional crops (cereals), but also expanding demand for livestock products and other high-value crops, which are also more labor-intensive. Agriculture has undergone rapid industrialization and intensification, with livestock playing a driving role. Since 2005, the growth rate of livestock has surpassed that of crop production, growing by about 5.3% a year from 2005 to 2013 (Figure 2.8), accounting for about 25% of agricultural GDP. As it was the case for many developing countries, Vietnam has entered the demand-driven "livestock revolution" (Delgado et al. 1999) which is reflected in both booming production (larger animal stock, higher animal density, higher output) (Figure 2.15, Figure 2.16 in *Appendix 6*) and consumption (Figure 2.17 in *Appendix 6*) and catalyzed by increasing urbanization, social transformation, food habit changes, and rising purchase power.

Nevertheless, such broad-based agricultural growth, within limited land availability, has faced challenges in view of sustainability. From an economic angle, Vietnam's agriculture has withstood more negative terms of trade since its market opened (higher input prices against unstable and lower output prices). While crop production relies greatly on external fertilizer sources, livestock and aquaculture are dependent on imported feed and feed

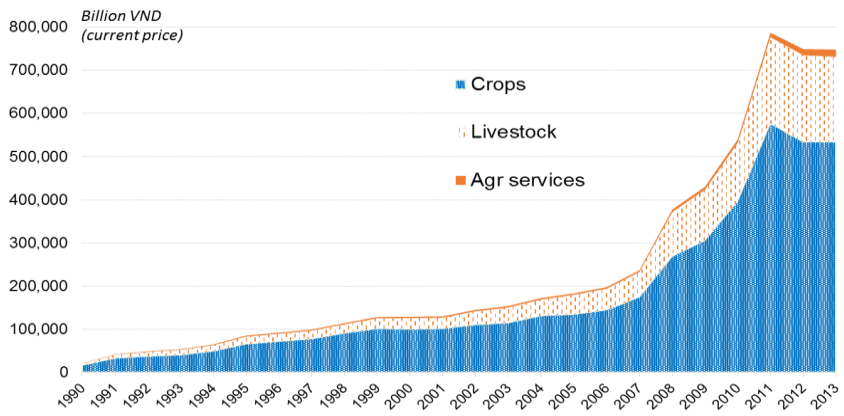
ingredients: soybean meals and fish meal (90% imported); minerals, vitamins, premix and other additives (100% imported). Vietnam has been a net importer of feedstuffs: 7.6 million tons of corn, 1.7 million tons of soybean (equivalent to USD 2.5 billion) in 2015 (Vietnam Customs 2016). This high dependency renders the livestock sector more susceptible to the fluctuations of supply sources and international prices. From an ecological perspective, a degrading environment and depleted agricultural landscape (due to overexploitation, abnormal and extreme weather events, and mushrooming hydropower facilities in the upstream…) make agriculture more fragile. For instance, aquaculture that developed along the coastal areas begins to suffer from negative environmental externalities (saltwater and brackish areas); water shortages during the dry season impairs the development of coffee areas; or rubber extension has generated uncontrolled deforestation over the past years). Therefore, debates have arisen over relevant farming arrangements in regard to import substitution for feeding animals to reduce animal feed imports and the depletion of the environment.

Figure 2.7: Structural changes in the agriculture sector



Source: Computation from GSO. Shares of sub-sectors in Gross Production Output, in current VND

Figure 2.8: Agricultural production output (billion VND)



Source: Computation from GSO. Shares of sub-sectors in Gross Production Output, in current VND

4.2. Smallholder farms versus commercial farms

The redistribution of land in the late 1980s and early 1990s has contributed to the growth of the country, but also left a heritage of small farms with very little and scattered farmland (Table 2.4). Both good and poor quality land was distributed to every households following principles of 'egalitarian' distribution. As collectivization was much radical in the North than in the South, the Northern provinces were affected more severely (Ravallion and Walle 2003). In 2003, there were around 75 million plots, each household held title to five to eight scattered plots, and 10% of these plots were smaller than 100m^2 (Markussen et al. 2016). Vietnamese family farms are very small (on average 0.8 ha per farm, 0.12 ha per farmer) compared to the regional and global level[38] (Chung and Dang 2012). Moreover, farmland has been shrinking under the pressure of urbanization and industrialization. Urban areas have spatially expanded by 2.8% a year (World Bank and MPI 2016). While most of industrial and transition countries can expand their land per farm and per farmer as the number of agricultural workers decrease, with very little land available (under 1 ha per farm), Vietnam is following the opposite trend of the Lewis Path (Dorin et al. 2013). Currently, on average, each household has 4 plots of land. Land consolidation is favored by the Government with respect to input intensive production, but concerns over environmental degradation have been voiced (deforestation, fishery resource depletion, land degradation, water pollution, nutriment surplus). The environmental footprint of agriculture has been broadened by the indiscriminative exploitation of land and water resources along with the intensive use of chemical fertilizers and pesticides (OECD 2015; World Bank 2016).

Table 2.4: Share of households by farmland size (%)

Farm size	2002	2006	2008	2010	2012
Under 0.5 ha	71.15	81.38	66.3	71.34	69.65
from 0.5 to 1 ha	11.87	4.31	16.1	14.3	15.39
From 1 to 3 ha	13.15	2.89	14.36	12.03	12.75
Above 3 ha	3.83	11.42	3.24	2.33	2.21
Total	100.00	100.00	100.00	100.00	100.00

Source: Computations from VHLSS 2002 – 2012

The land consolidation process is clearly shown in the changes in the proportion of farm subgroups of under 1 hectare (Table 2.4). Land consolidation occurs through land transfers from the poor to the non-poor group, or from services households to agricultural

[38] Global average farm size is 2.3 ha. At the regional scale, average farm sizes are: 0.73 ha in Bangladesh, 1.33 ha in India, 1.37 ha in South Korea, 3.65 ha in Thailand (FAO 2009)

households to optimize available resource endowment. This trend has been accompanied by a decreasing number of agricultural households (from 11.2 million to 9.3 million households between 2001 and 2016), especially in rural areas. Among 13 million rural households in 2001, 80% were invovled in agriculture production. Fifteen years later (2016), only 53% of the 15.9 million rural households worked in the agricultural sector (Table 2.6 in *Appendix 5*). Small productive land, labor-intensive work and low returns push rural farmers to diversify their activities from agriculture to non-farm work and generate income from different sources or migrate to cities for seasonal opportunities. An "Archipelago" household (Losch et al 2012) in rural Vietnam can generate income from 8 different sources (Son et al. 2006).

Agricultural policies and incentives have facilitated the switch from subsistence farming to commercial-oriented farming with higher concentrations of land, capital, and hired labor. Large-scale farms allow farmers to benefit from economies of scale, especially in the context of more expensive agricultural labor and labor saving technology. Commercial farms[39] in Vietnam are characterized by either large-scale land (for cultivation and aquaculture) and/or big animal herds (for livestock). On average, in 2011, a commercial farm had 7.7 ha of farmland. Farmers expand their operational farmland in different ways: additional land transferred by or contracted with local authorities or cooperatives (for annual crops, aquaculture or fisheries); leasing land from former state farms[40] (for perennial crops) (Son et al. 2006). Despite changes in the legal definition of commercial farms (2001, 2011), the most rapid increase over time has been observed in livestock commercial farms (Figure 2.9). In the context where most arable land is devoted to crop production (especially rice), livestock farmers enlarge their production to a commercial scale through intensification: bigger herd within stable acreage, leading to higher density. The increasing concentration and intensification of livestock production is on one hand a response to the booming demand that has shaped the "livestock revolution", and, on the other, to policy incentives. The Livestock Development Strategy (2008) and the Plan for Restructuring the Livestock Sector (2014) highlight the transformation of the sector toward industrialized and modern modes of production, i.e., more intensive, more specialized and more concentrated, in order to reduce imports and be better prepared to compete with imported livestock products under FTAs (VERP 2015). Smallholder livestock structures were once considered by the Government as an effective means to reduce poverty and improve livelihood (ILRI 2000), but now are perceived as a factor

[39] See *Appendix 4* for more details

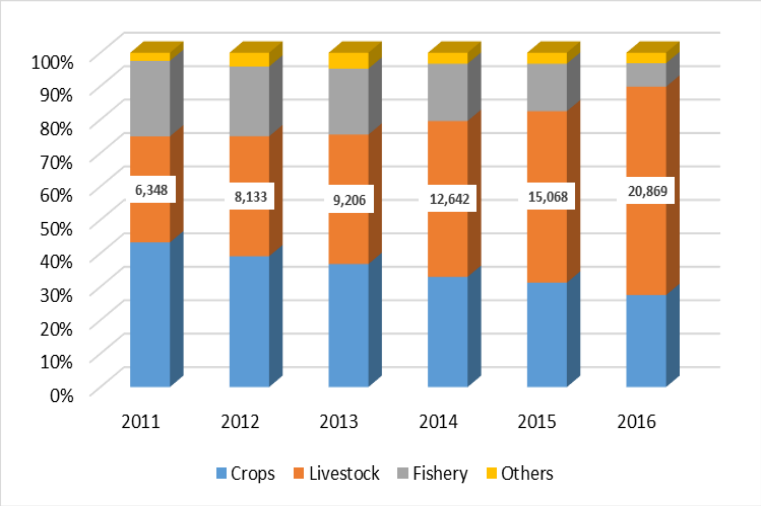
[40] During the land reforms in 1988, only 75% of total disposable land was allocated to households. The remaining 25% of agricultural land were still managed and used by state agro-forestry farms.

limiting enhanced economic productivity and competiveness advantages. From a social viewpoint, the development of intensive and large-scale modern farms will increase labor productivity, but hamper rural employment. So, in the prevailing livestock revolution, should smallholder farms or large-scale intensive farms be valorized? The participation of farmers in value chains and modern distribution revolution are likely to have a substantial impact on agriculture systems (Reardon and Berdegué 2002; Thapa and Gaiha 2014; Hazell and Rahman 2014).

Figure 2.9: Emergence of commercial farms

Source: AgroCensus 2011, 2016 (GSO); Annual statistics 2012-2015 (GSO).

Note: Since 2011, Vietnam Government amended the criteria for commercial farms (Circular 27/2011/TT-BNN (13 April 2011) replacing the Interministerial Circular 69/2000/TTLT-BNN-TCKT (23 June 2000). Accordingly, commercial farms are certified as such they meet stricter criteria with regard to the scale of production (farmland, animal herd) and/or production output value. The previous criteria referred only to the scale of production. (See Appendix 4 for details)



4.3. Restructuring the value chain

The change in the agricultural sector has occurred within a broader diversification, known as the value chain transition, involving input providers (feed, seed, fertilizers, farm equipment, logistic firms, business service providers) as well as agribusinesses (processors, distributors, retailers) (World Bank 2007, 2016). There have been a number of public and private efforts to restructure and upgrade fragmented value chains, i.e., organizing both upstream and downstream of the farming stage that accommodates smallholder farmers: schemes of "large fields" (termed *"cánh đồng lớn"*)[41] in crop production, vegetable outgrowing scheme for large distributors (Metro Cash and Carry, Big C, etc.), various contract farming patterns in livestock production (integrated linkage with CP, captive governance steered by dairy companies (Vinamilk, IDP, Fresh Campina

[41] "*Cánh đồng lớn*" refers to a way of organizing agricultural production based on linkage between farmers, farmer organizations and enterprises: all participating farmers cultivate on a certain large area (aggregated by their land parcels) with a same code of practice and enterprises are responsible for product sales. Objectives of 'large fields' are to promote advantage of economy of scale (important output volume), improve quality of products and increase competitiveness in view of higher efficiency and better farmers' income (Decision 62/2013/QD-TTg of Prime Minister, 25 October 2013). By 2016, there are 2,262 "*Cánh đồng lớn"* across the country, involved by 619,343 households, covering 579,284 hectares (253 ha per field on average). Most of *Cánh đồng lớn* are dedicated to rice production (1161 fields). Other main cash crops include: corn (50), sugarcane (95), vegetables (162), tea (38) (GSO 2017).

Vietnam, ….). Increasing vertical capital accumulation (Fortier and Trang 2013) and larger production scale, thanks to market reforms, enable stakeholders higher and lower along the value chain to benefit from the deeper dependency of farmers on inputs and services as well as processing and trading oligopolies. Farmers get smaller profit margins because of the larger pie parts caught by upstream service providers and downstream processors or wholesalers. Vietnamese farmers, due to their small production scale, are locked into the trap of more capital and credit to raise productivity (chemicalization, mechanization and commercialization) and higher exposure to wider risks in the hope of recovering profit from diminishing returns (Young et al. 2002). Furthermore, the emergence of agribusiness with closed production-commercialization cycles (for instance, TH Milk) puts further pressure on rural labor, especially agricultural labor. The income gaps between farmers and other workers therefore persist.

5. Transformation and development trajectory at the territory level (Ba Vi district)

National dynamics also put social and structural changes in motion at the local level (province, district) in the motion. This section explores how the above-mentioned structural changes and agricultural transformations have happened at the local level, specifically in Ba Vi district, which is located in the vicinity of Hanoi city, at the heart of the Red River Delta – the most densely populated area of Vietnam. Prior to its integration into Hanoi in 2008, Ba Vi was the largest district of Ha Tay province. Ba Vi is located around 50 km to the west of Hanoi center with the Red River to the north, Da River to the west, and the Bavi mountain range standing as a buffer between the Red River Delta and the northwest mountains (*Tây Bắc*). As home to three ethnicities, of which *Mường* and *Dao* are native to the area while *Kinh* have migrated there since the 1960s, the district consists of 1 town and 31 communes spread accross a diversified landscape[42]: lowland, hilly and upland (Figure 2.18, Table 2.7 in the *Appendix 7*). The diversity of the particular landscape reflects a long historical process of economic and political changes, especially in agriculture, which encompasses a variety of farming activities (rice growing in lowland zones by the rivers, perenial crops (tea, fruit) in the hilly zone, livestock in the upland zone) as well as toursism actvitities in close to Hanoi. Tourism (natural-ecologic and spiritual) contributed 29% of the district's GDP in 2015 (2.5 million visitors).

[42] Mean annual temperature of 21.5ºC on average (minimum at 16.4ºC in January, maximum of 28.9ºC in July). Precipitation of 1500-1600 mm per year (highest rainfall between June and September – 300mm, and lowest rainfall between December and March, 40mm).

5.1. From collectivization to decollectivization

Like elsewhere in the country, the district witnessed a significant collectivization of productive means and assets during the 1960s-1970s. The government launched an economic development movement in upland and remote regions by setting up a number of state agroforestry farms. Increasing demand for labor for land reclamation to boost agricultural production encouraged a great flow of migration from other provinces into the Red River Delta, where the population was increasing. Rice was not only grown in lowland accessible to irrigation, but also hillsides. In addition to traditional crops like rice, sweet potatoes, and plantation crops (tea, fruits), livestock (meat and dairy cattle) and forage crops were introduced and encouraged. Dairy cow herd under the management of Ba Vi State farm was tripled during the 1960-1970 period (from 384 to 1067 cows, from 147 tons to 718 tons of milk) (BVFRC 2009). Cropping rotations were put in place to make the soil fertile (peanut- sweet potato-pangola grass or peanut-elephant grass-peanut) or to produce crop residues for feeding animals (sugarcane for example). Collectivization transformed the local agrarian system, but also posed a number of challenges to farmers' livelihoods and territorial development.

Reforms and incentives under *Doi Moi* (1986) opened a new phase of development as private sector and family farming were encouraged. Land and livestock distributions[43] (first distribution in 1987; second distribution in 1989-1990) from State farm to farm workers enabled farmers to generate initial capital stock for further investment in livestock later on. Land was always allocated in an equal manner (cattle, active members of the households and quality of land plot).[44] Paddy land of the Ba Vi Research Center was also distributed to households which then tripled rice yield (3 tons per hectare, or even 5 tons) (BVFRC 2009). Intensive crop production has grown with average earnings increasing by 25% based on high-yielding cash crops: expansion of soybean and peanut, promotion of winter crops. Extended land use tenure and LUR (certificated in form of "Red Books") have endowed farmers as a resilience of those farming systems by encouraging long

[43] Except a portion of land reserved for state farm, most of the land (rice land and hilly land) was distributed according to the number of family members recorded (660m^2 per active member) for 5-year term. Distribution of hilly land (for cassava and fruits) was said to be only available to the cooperative management team (C. Gironde 2009)

[44] Land distribution principles: 1260m^2 or 360m^2 (above 55 years old or under 18 years old); 50% of "land of bad quality" (not irrigated – 1 crop cycle) and 50% of "land of good quality" (irrigated – 2 cropping cycles)

term investment. However, for those set up on the land of the State farm, the absence of ”Red Books” prevents them from accessing credit.[45]

Although land tittle issue somewhat hinders the agriculture growth, contribution of agriculture to the district GDP (45% in 2013) is supported by government interventions: biologisation, irrigation, mechanization, chemicalization and electrification. These interventions have also facilitated the shift of agricultural labor to non-agricultural activities. The proportion of households engaged in agricultural production shows a downward trend, from 81% of households in 2007 to 75% in 2013 (Table 2.5). A significant portion of labor have been withdrawing from agricultural activities to engage in services activities (catering, handicrafts, etc.) around tourism places in the district or to migrate to Ha Noi for off-farm job opportunities.

Table 2.5: Dynamics of rural households in Ba Vi

	2007		2009		2013	
Total households (HHs)	58,384	*(100.0%)*	56,982	*(100.0%)*	52,715	*(100.0%)*
Agricultural HH	47,291	*(81.0%)*	43,876	*(77.0%)*	39,616	*(75.2%)*
Non-agricultural HH	8,758	*(15.0%)*	10,825	*(19.0%)*	10,832	*(20.5%)*
Mixed HH	2,335	*(4.0%)*	2,281	*(4.0%)*	2,267	*(4.3%)*
Total employment (emp.)	125,296	*(100.0%)*	129,835	*(100.0%)*	123,731	*(100.0%)*
Agricultural emp.	101,201	*(80.8%)*	97,508	*(75.1%)*	91,510	*(74.0%)*
Nonagricultural emp.	19,547	*(15.6%)*	26,082	*(20.1%)*	26,078	*(21.1%)*
Other employment	4,548	*(3.6%)*	6,245	*(4.8%)*	6,143	*(5.0%)*

Source: Economic Department, DPC of BA Vi, 2014. Figures in bracket are share of household groups

5.2. Livestock taking stock

Apace with the process of decollectivization and market liberalization, livestock has been emerging as a contributor to local development. Livestock accounted for 65.6% of the total agricultural output of the district in 2014 while crops accounted for 32% and agricultural services contributed 2.4% (Ba-Vi DPC 2014). Pig and poultry did not make great gains due to price fluctuations and animal diseases. The pig and poultry population has gone down, while dairy production has been on the increase with bigger herds (eightfold increase from 1088 cows to 8871 cows between 2001 and 2014). This upward trend of dairy production has been supported by Government policies since 2000 (Decision 167, National Dairy Development Program in 2001) and agribusiness

[45] Research Center concludes contracts with households in form of “Green Book” acknowledging the right of exploitation on defined area over a 50-year term. Contracts also defined articles on annual prime paid to the Center (in paddy output by equivalent)

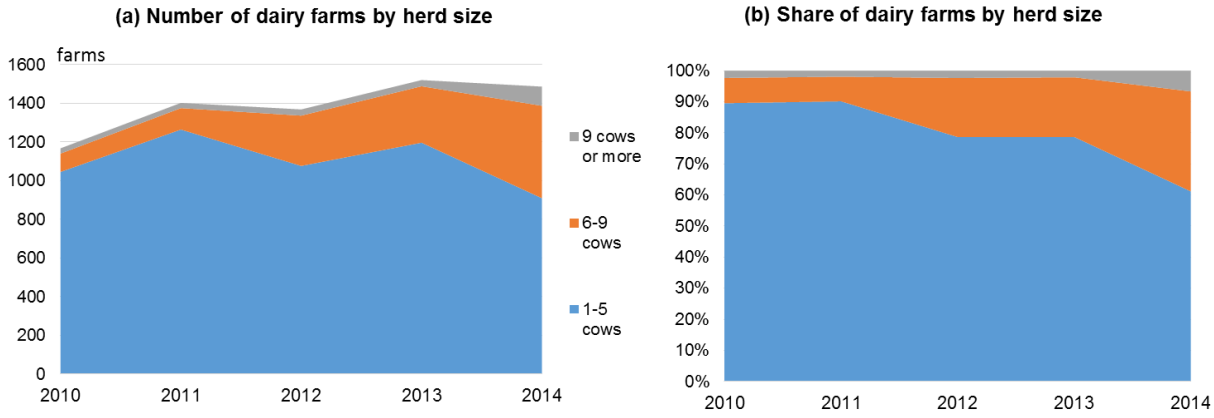
investments (Nestle from 1997 to 2005; IDP[46] since 2007) and stabilized farm-gate prices. Ba Vi is currently the second largest milk basin in North Vietnam.

The expansion of dairy production goes with the changing land use pattern characterized by an intensification between 2003 and 2013. In winter, the index of vegetation increase with the introduction of a 3rd cycle of corn production and a significant increase of fodder crops.[47] Tea and rice have gradually been replaced by corn and elephant grass for feeding cattle. Dairy farms, in place of diversifying food or cash crops, focus on fodder production and dedicate 60% of their agricultural land within farms to grow grass (elephant grass, king grass or VA06). However, it is difficult for local breeders to find sustainable fodder and forage resources. On average, a small-scale farmer in Ba Vi has 4545 m^2 for dairy production. In terms of land per cattle, this area is relatively sufficient to raise intensively 4 to 5 cows under suburban conditions in Vietnam (Garcia et al. 2006) (equivalent to 14 cows per ha, while density in France on average is 2 cows per hectare). It is a very intensive crop-livestock system as crops produce 70% of the biomass consumed by cows. However, given the limited land available, it is difficult to find sufficient green feed for large herds. For instant, agricultural land (for production of grass,[48] maize, cassava, rice straw) in the commune of Tan Linh just meets the herd of 1,700 dairy cows. An additional 300 cows by 2013 would require a further 300 tons of dry matter, or an additional 10 ha producing feed crops. If the herd increased to 11,000 cows in 2020, according to the scenario of the local government, an additional 300 ha would need to be allocated to forage production. Ba Vi is still characterized by small farms and limited land for dairy production (0.39 ha land per farm of which 0.29 ha for forage) (Table 2.8 in *Appendix 7*) that challenges environmental management at the farm level (manure and liquid waste treatment). Although the majority of dairy farms have small herds, from 1 to 5 cows, an upward trend of bigger herds of more than 9 cows is observed (100 herds in 2014)) (Figure 2.10). Dairy cows are all raised in barns and fed with concentrates bought outside together with forage. Lairez (2012) and Khanh (2016) show that diversified farms (crops and dairy production) are more resilient and more associated with an autonomous fodder system. It is not the case for other farms which have to buy corn, rice straw, king grass or cassava. Meanwhile, the informal market of fodder is not well organized and access to local feed is not transparent. Farmers have to rent 20% of their agricultural land (from land owners who are Hanoi investors) for feed crops and continue

[46] International Dairy Production
[47] The diffusion of silage techniques plays a role in cropping transformation, but is not very effective.
[48] Some grass species can be grown all year round, but at slow growth during the dry and cool season. Elephant grass (*pennisetum purpureum)* and guinea grass (*panicum maximum)* are grown most in the region.

to rely on industrial concentrates. Feed account for 70% of the total production costs and burden the income of farmers.

Figure 2.10: Dairy farm size in Ba Vi (2010 – 2014)



Source: Center for Livestock Development of Hanoi, 2015.

5.3. Urbanization and industrialization challenge land and employment availability

Proximity to Hanoi, a large city, offers the locals both advantages and disadvantages. On one hand, farmers have convenient access to input and output markets as well as seasonal off-farm work and nonfarm opportunities. On the other hand, the rapid urbanization and industrialization of the capital region is putting pressure on agriculture. Land in Ba Vi is mainly agricultural land, 28,567 ha out of 42,804-ha total land (Figure 2.19 in *Appendix 7*). There is a slight declining trend in agricultural areas over the past years due to expanded residential land and land for industrial purposes.[49] However, the situation is much worse if per capita landholding and land per agricultural worker are considered (0.08 ha per capita in 2013; 0.187 ha per agricultural worker in 2013). A slight rise in land per farm (0.433 ha per farm in 2013 from 0.37 ha in 2007) would still be a prerequisite for growth generated by agriculture in the future (Table 2.8 in *Appendix 7*).

Under rapid urbanization, a number of households lost their means of subsistence due to reclaimed agricultural land (Thắng 2009), forcing them to earn their livelihood outside farming activities. Furthermore, instability of prices of agricultural products (pork, poultry) also pushed farmers to give up agricultural activities to take up other occupations (i.e., non-farm activities at home or in Hanoi center). The formation of BaVi National Park

[49] With the boom in the real estate market, where the land prices went up in 1990s and early 2000s, many locals sold their by-road land and moved to further away. However, these 'agricultural' lands are not fixed on the base of market prices. The system excluded the poor farmers from development (Mellac et al. 2010). Accordingly, local dairy farmers have to hire land from estate investors to produce forage.

(1991), Tourism Development Scheme (2000), and Hanoi geographical extension (2008) have jeopardized the economic structure of the district. Extended tourism facilities have not helped the poor and have not sought to balance their needs in terms of resource use (land, water, forest) with those of the farming sector in the region. The most difficult task is to make the gains and benefits from farming (especially dairy production) and non-farming activities (especially tourism) converge. Hanoi have planned in 2016 an amended expansion scheme in its vision for 2030-2050. Accordingly, the region is planned to integrate surrounding provinces as satellites of Hanoi. This strategy will place higher pressure on agricultural land, agricultural labor and pose other challenges to the sustainable and inclusive development of BA Vi district in particular and other peri-urban zones in general.

6. Conclusion: Way forward to sustainable and inclusive development

The comprehensive political and economic reforms of 1986 initially backstopped by agrarian reforms has transformed Vietnam from a centrally-planned economy to a *'socialist-oriented market economy'*. It has contributed to poverty reduction and the country has emerged as a major exporter of agricultural commodities. The Lewisian development pathway opposes to the ongoing dynamics of the country: perceptible decline in share of agriculture in GDP, the continued predominance of rural population (60% of the total population in 2015), farmers on the increase (in absolute terms) but getting poorer compared to other workers in the economy. Theoretical and empirical facts and figures at different levels (national, sector, territory) suggest that the expected sustainable and inclusive development of Vietnam is beset with a number of challenges.

As the structural transformation continues, will Vietnam follow the current development path (i.e., Lewis Trap)? Although growth can be regarded as a credible performance for the agriculture sector, recent emerging problems (rising labor costs, income inequality, resources management, environmental degradation, etc. have left doubts to sustain GDP growth and to accelerate structural transformation in the coming time. Slower growth in agriculture reveals that the sector, which once enjoyed fast growth driven by institutional changes, is now trapped by out-of-disposal cheap resource locus. Increasing demographic pressure on land and a shortage of alternative nonfarm employment opportunities continue to aggravate the situation. Both the public and private sector will be further challenged by the twin goals of the structural transformation: improving the welfare of farmers and the poor and decreasing income equality. Policies and investments should therefore incentivize productivity increases in agriculture (improving

access to credit for small and medium farmers, education and extension services enabling farmers to adopt technology; no distortion of trade on production factors) in parallel with the creation of non-farm opportunities.

Doi Moi has revitalized family farms that have been the backbone of national development for the last 30 years. However, ongoing agrarian dynamics (sectorally and locally) have not been entirely inclusive from the angle of different farming structures. Government policies have recently offered more support to large-scale farms than to small and resource-poor farmers. Proponents of large-scale farms and mega farms claim that economies of scale are more remunerative, especially in the context of more expensive agricultural labor and numerous labor saving technologies. Large-scale farms are promoted for their responses to the skyrocketing demand for food (especially livestock products in the current "Livestock Revolution"), ability to adopt advanced technology, application of quality control and response to pressing competition from foreign products. However, the form of large-scale farms poses ecological, economic and social threats in rural areas. Land constraints also are hindering farmland expansion. It seems that farms in Vietnam will remain small by international standards in the future. But small farm size will not necessarily mean that farm households will remain poor or become inefficient. Smallholder agriculture could be viable, and more socially and environmentally efficient than larger farms (IPES-Food 2016). Therefore, more evidence is needed to prove that small farms are less efficient than large farms. For now, to meet the different inclusive development objectives, Vietnam is likely to embrace a dual farming model. On one side, like industrialized countries located on the Lewis Path, Vietnam will accommodate large-scale farms and agro-industries to feed its people with cheap protein, carbohydrates and lipids. On the other side, smallholders and family farms which are more connected to the market will continue. The operations of smallholder farms will be conditioned by the investment portfolios and policy choices made by the Government (i.e., interventions in different domains concerning agricultural and rural areas: food safety, environmental standards, irrigation, investment regulations and incentives, provision of pubic goods (both hard and soft elements: roads, electricity, education and training…). From the value chain perspective, Vietnam will follow Asian countries to rely on small farms upstream and large trading and large processing operations downstream.

Like its neighbors, Vietnam is challenged by a declining share of agriculture in GDP and increasing demographic pressure. The country has reached the cultivation frontier where there is hardly any new land available for agricultural production and forest land has been

overexploited for the sake of hydropower plants. More deforestation for farmland will increase the risks of drought, floods, land degradation and environmental instability that adversely affect agriculture, forestry and fisheries. However, agricultural transformation, has shown its second environmental facet: natural landscapes depleted by intensive agricultural production (over use of pesticide and fertilizers), decreasing mangrove areas due to rapid aquaculture expansion, absence of environmental regulations, etc. Threats posed by high human and livestock densities may lead to environmental degradation and limit the eradication of animal diseases. This will have a negative influence on sustainable growth. Thus, for farming to be a viable pursuit in the future, the performance of the existing system must be improved by adopting more sustainable farming practices (i.e., mixed crop livestock system, agro-ecological agriculture, climate-smart agriculture, etc.). These strategies will internalize any costs to the environment (because they are highly self-reliant as nutrient and energy flows from crops to livestock and back).

This paper embraces economic dynamics at the national and local level and transformation within agricultural sector with the higher role of the livestock sector and more weighted on the larger/commercial farms. As transformation is often viewed from a macro perspective, the microenvironment (territory) and socio-ecological stances contributes to the structural dynamics. The current Government's agriculture and climate change strategy rests on the assumption that large-scale and modern agriculture, with intensive production, mechanization and advanced technology, can realistically meet growing domestic demand and better address adverse environmental externalities (better diseases control, better waste treatment, standardized quality control, etc.). Yet, under increasing competition from nonfarm sectors and cities (for land, labor and water), over-intensive inputs and natural resource use leave have significant consequences on farm profitability, farmer wealth and the environment. In this context, besides accelerating sector convergence in terms of income and job opportunities (i.e., Lewis Path), from multi-dimensional standpoints (economic, social and environment) and from a multi-functional agriculture perspective (socio-cultural role, ecosystem services) (Viswanathan et al. 2012), *"a paradigm shift from industrial agriculture to diversified agro-ecological systems"* (IPES-Food 2016) in the continuing agrarian transformation and structural transformation has emerged in policy discussions and calls for further R&D, technology changes and institutional innovations. It should take into account different models of agriculture based on diversifying farms and farming landscape to maintain the agricultural diversification at the farm level and to protect small farmers.

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Appendix

Appendix 1: Summary of model reference for computing structural transformation

Models presented by (Dorin et al. 2013)

Given: ***Y*** = total value-added of the economy; $\boldsymbol{Y_a}$ = total value-added of the economy

L = Total workforce (heads); $\boldsymbol{L_a}$ = Workforce in agriculture (head)

$\boldsymbol{\theta}$ = Average labor productivity (Y/L); $\boldsymbol{\theta_a}$ = Agricultural labor productivity (Y_a/L_a)

Labor Productivity Ratio (LIR) show the ratio between share of agriculture in output and share of agriculture in employment (based on Hayami and Godo (2004))

$$LIR = (Y_a/Y)/(L_a/L)$$

LIR increases only when agricultural labor productivity grows faster than the average labor productivity:

$$\ln(LIR) = ln(Y_a) - ln(Y) - ln(L_a) + ln(L) = ln(\theta_a) - ln(\theta)$$

$$\dot{LIR}/LIR = \dot{\theta}_a/\theta_a - \dot{\theta}/\theta$$

The number of agricultural workers decrease only when agricultural labor productivity grows faster than the agricultural output.

$ln(\theta_a) = ln(Y_a/L_a)$ $\qquad$ $\dot{L_a}/L_a = \dot{Y_a}/Y_a - \dot{\theta_a}/\theta$

Based on the sign of the variation of *LIR* and L_a, there are 4 potential transformation paths:

- Path A (*Farmer-Developing*): Farm and nonfarm labor income converge (*LIR* → *1*) while the number of farmers increase ($\dot{L_a}/L_a > 0$)
- Path B (*Lewis Path*): Labor incomes also converge but the agricultural workforce decreases.
- Path C (*Lewis Trap*): The income differential widens ($\dot{LIR}/LIR < 0$) and the agricultural workforce increases
- Path D (*Farmer-Excluding*): The number of farmers decreases and the income gap with non-agricultural workers widens

			Active Population in Agriculture	
			Increasing	*Decreasing*
			$\frac{\dot{L_a}}{L_a} > 0$ $(\dot{\theta_a}/\theta < \dot{Y_a}/Y_a)$	$\frac{\dot{L_a}}{L_a} < 0$ $(\dot{\theta_a}/\theta < \dot{Y_a}/Y_a)$
Income gap between agricultural and non-agricultural workers	*Narrowing*	$\frac{\dot{LIR}}{LIR} > 0$ $\left(\frac{\dot{\theta_a}}{\theta_a} > \frac{\dot{\theta}}{\theta}\right)$	**[A] Farmer-Developing (ED)** $\left(\frac{\dot{Y_a}}{Y_a} > \frac{\dot{\theta_a}}{\theta_a} > \frac{\dot{\theta}}{\theta}\right)$	**[B] Lewis Path (LP)** $\left(\frac{\dot{\theta_a}}{\theta_a} > \frac{\dot{Y_a}}{Y_a}, \frac{\dot{\theta}}{\theta}\right)$
	Growing	$\frac{\dot{LIR}}{LIR} < 0$ $\left(\frac{\dot{\theta_a}}{\theta_a} < \frac{\dot{\theta}}{\theta}\right)$	**[C] Lewis Trap (LT)** $\left(\frac{\dot{\theta_a}}{\theta_a} < \frac{\dot{Y_a}}{Y_a}, \frac{\dot{\theta}}{\theta}\right)$	**[D] Farmer-Excluding (LE)** $\left(\frac{\dot{\theta}}{\theta} > \frac{\dot{\theta_a}}{\theta_a} > \frac{\dot{Y_a}}{Y_a}\right)$

Appendix 2: Data description

1. Simulation of structural transformation trajectories

Population: The data are retrieved from FAOStat 2014 to get the sub-segments (total population (N), urban population (N_u), rural population (N_r), total economically active population (**L**) and total economically active population in Agriculture **(L_a)**

Value added by economic activities from UNSTAT, 04 March 2017, of which Total value added **(Y)** and Value added of the Agricultural, hunting, forestry, fishing (ISIC A-B) (**Y_a)** at the constant 2005 prices in US dollars (US $)

2. Employment and GDP data by broad sector

Employment: The data (1980-2015) are consolidated and retrieved from General Statistics Office, including annual statistics and annual Reports on Labor Force Survey 2011-2015.

GDP: The data (1986-2014) are consolidated and retrieved from annual statistics of General Statistics Office and FaoStat 2015.

Gross Production Output by agricultural sub-sector (in current VND) are computed from annual statistics of General Statistics Office.

3. Population data

Population: Total population (1970-2015) are retrieved from Faostat (2015)

Active population: Total active population and Agricultural active population for 1970-2004 period are retrieved from Faostat, 2015. Total active population and Agricultural active population for 2005-2015 are retrieved from GSO (2015)

4. Household and farm data

Household income are computed from Agricultural, Rural and Fishery Census Surveys (GSO)

Farmland: Farmland size by different cohorts are computed from Vietnam Households Living Standard Survey 2002-2012.

5. Livestock data

Herd population by species: data 1970-2000 are retrieved from Faostat (2015), data 2001-2014 are consolidated from Department of Livestock Production (2015)

Supply of animal products per capita (2001-2013) are consolidated and computed from Department of Livestock Production (2014)

Appendix 3: Milestones of policies in agriculture and rural development

Year	Agricultural sector reforms
	Reunification period (1976-1985)
1979	Experiments with contract system in agricultural and industry production
1981	Decree 100 implemented as pilot for unleashing the agricultural sector
1985	Failure of price-wage-money adjustment scheme
	Renovation (1986-1993)
1986	*Doi Moi* (Renovation) adopted
1987	Promulgation of Foreign Investment Law
1988	Resolution 10 launched, abandoning the collectivization system: *Allocating collective land to individual farm household on long term basis*
1989	Price reforms: *liberalizing all prices, including interest rates and the foreign exchange rates;*
	Banking system decentralization;
	Commercial control quotas for 12 commodities
1990	Law on Companies and Law on Private Enterprises;
	Law on State Bank and Law on financial institutions;
	Re-arrangement of state enterprises;
1991	Abolition of most incentives and supports to SOEs
1992	Constitution 1992 was adopted and replaced Constitution 1980. The private sector is acknowledged and recognized in the paper.
	Expansion (1993-2000)
1993	The Land Law was adopted. It gave 20-year contract for land assigned for the growing of annual crops and 50-year contract for land assigned for growing perennial crops; Regulations on land limits, and Land use right (LUR);
	Establishment of floor price for rice
1996	Law on Cooperatives: clarifying cooperatives' role as providers of services to households.
1998	Revise and Amend Land Law
2000	Amended Law on Foreign Investment;
	Combine Law on Enterprises and Law on Companies
	Removal of quotas on fertilizer imports
	VN-USA Bilateral Trade Agreement signed
	Resolution 03/2000/NQ-CP (02 Feb 2000) on farm economy
	Integration (2000-2008)
2001	The Land Law was amended to permit foreign investor to acquire agricultural land and to allow farmers to exchange portions of fragmented land holdings to consolidated holdings;
2002	Decision 80/2002/QD-TTg (24 June 2002) on farming contract
2003	Amended Land Law: to allow holders of land-use certificate (contracts) to buy and sell their

	usufruct rights in land or change the functional assignation of their land, within the overall indicative planning framework of the government. Communes were allowed to change functional purpose classification of land.
	Re-arrangement and reformation of state agro-forestry farms. State forestry farms were obliged to reform and to reallocate forestry land to local communities that mostly are composed of ethnic minorities
2004	Further changes of the land law gave land rights to both husbands and wives thereby promoting gender equality
	Reorientation (from 2008)
2008	Resolution 26 on Agriculture – Farmer – Rural development
2010	Decision 800 - National Target Program New Rural Development (NTP-NRD)
2012	The Law on Cooperatives was amended
2013	Decree 210 on encouraging enterprises invest in agriculture and rural sector
	Decision 62 on encouraging cooperation and linkage in contract farming and large-scale fields
2014	Agricultural Restructuring Plan (ARP) was adopted. Then, a series of detailed restructuring schemes for sub-sectors were constituted, livestock restructuring scheme

Appendix 4: Some specific legislation under Doi Moi and legislative definition of commercial farms

4.1. Background legal documents for Doi Moi: Directive 100 (1981) and Resolution 10 (1988)

Directive 100 *(100-CT/TW dated on 13 January 1981 on improving end-production contract)*

- All land and production means were to be placed under the management and disposition of cooperatives;
- Cooperatives was responsible for organizing production and handling business affairs. The farmers were not entrusted with entire production process but three production links: seed sowing and planting, weeding, crop tending and harvesting.
- Cooperatives was specialized in 5 other production links: plowing, seed supply, irrigation and drainage, chemical fertilizers supply and plant protection
- The cooperative was to collect all production and then distribute a portion to farmers according the work done.
- The farmers could sell the surplus and pocket the money after delivering to the cooperative a quota of food stipulated in the Contract.

Resolution 10 (*Resolution 10-NQ/TW dated on 5th April 1988 on management reforms in agriculture)*

- Allocate land to farmers for 15-year term;
- A number of production mean (buffaloes, machines,…) are distributed to cooperative members;
- Households were recognized as autonomous and self-reliance economic unit and trade-manufacturing organism that can exist independently (free farm land leasing, right to use and sell products, responsible for their own businesses, employ workers ;
- Cooperative assumes role carrying out service activities to farmers
- Cooperatives and peasant's obligation to the State: agricultural taxes.
- Relation between State, peasants and groups are equalized by market principles which replace the good-based relationship

4.2. Definition of commercial farms in Vietnam in 2000 and 2011

Circular 69/2000/TTLT-BNN-TCTK (23 June 2000)

Farm type		**North, Central Coast, Highland**	**Southeast and Mekong River Delta**
	Revenue	40 million VND	50 million VND
Crop production	Annual crop	2 ha	3 ha
	Perennial crop	3 ha	5 ha
Forestry	Forestry area	10ha	10 ha
Livestock	Ruminant cattle	10 dairy cows or 50 beef cattle	
	Pig and small ruminant	20 goats or 100 sheep for breeding (reproduction) 100 fattening pigs; 200 goats for meat	
	Poultry	2000 heads	
Aquaculture	Aquaculture production	2 ha (or 1ha for industrial shrimp aquaculture)	

Circular 27/2011/TT-BNN (13 April 2011)

Farm type	**North, Central Coast, Highland**	**Southeast and Mekong River Delta**
Crop production (annual, perennial) Aquaculture production Mixed production	Area: 2.1 ha Revenue: 700 million VND	Area: 3.1 ha Revenue: 700 million
Forestry	Area: 31ha Revenue: 500 million VND per year	
Livestock	Revenue: 1,000 million VND per year	

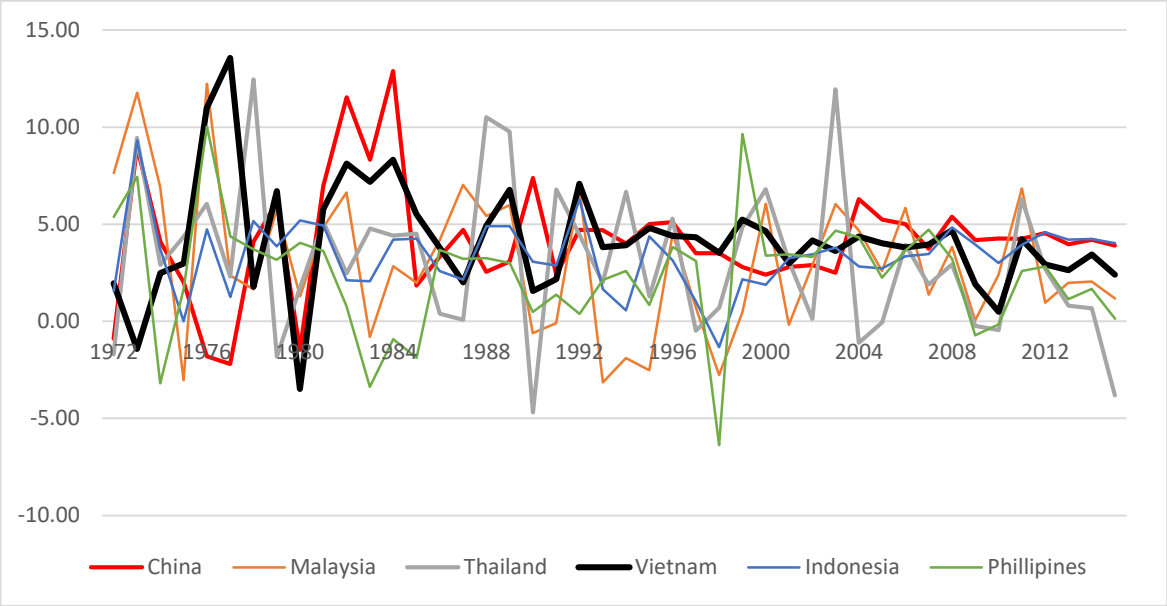
Appendix 5: Data Sheet - Country

Table 2.6: Changes of agricultural household over Agri-Census (2001 – 2016)

	2001	2006	2011	2016
Agricultural Households (whole country)	**11,228,701**	**10,462,367**	**10,368,143**	**9,318,307**
By zone				
- *Rural areas*	10,573,597	9,783,644	9,535,548	8,610,269
- *Urban areas*	*655,104*	678,723	832,595	708,038
By activity				
- *Agri. HHs (crop and livestock)*	10,689,753	9,740,160	9,591,696	8,490,611
- *Forestry households*	26,606	34,233	56,692	114,543
- *Aquaculture households*	512,342	687,984	719,755	713,153
By region				
- *Red River Detal*	2,787,505	2,248,062	1,999,522	1,555,821
- *Northeast and Northwest Mountain*	1,837,431	1,813,564	1,905,943	1,901,369
- *Central Coast*	2,605,396	2,669,079	2,629,422	2,297,523
- *Central Highlands*	695,878	751,647	864,810	932,378
- *SouthEast*	890,375	616,638	602,426	529,911
- *Mekong River Delta*	2,412,116	2,363,413	2,366,020	2,101,305
Total rural households	**13,065,756**	**13,768,472**	**15,343,852**	**15,988,375**
Agricultural HHs	10,573,597	9,783,644	9,535,548	8,610,269
- *Agricultural HHs (crops and livestock)*	10,106,615	9,149,118	8,866,510	7,864,788
- *Forestry households*	24,343	31,566	51,862	108,509
- *Aquaculture households*	442,639	602,960	617,176	636,972
Industrial households	752,204	1,401,943	2,305,794	3,218,468
Services households	1,381,251	2,054,193	2,825,423	3,105,066
Others	358,704	528,692	677,087	1,054,572

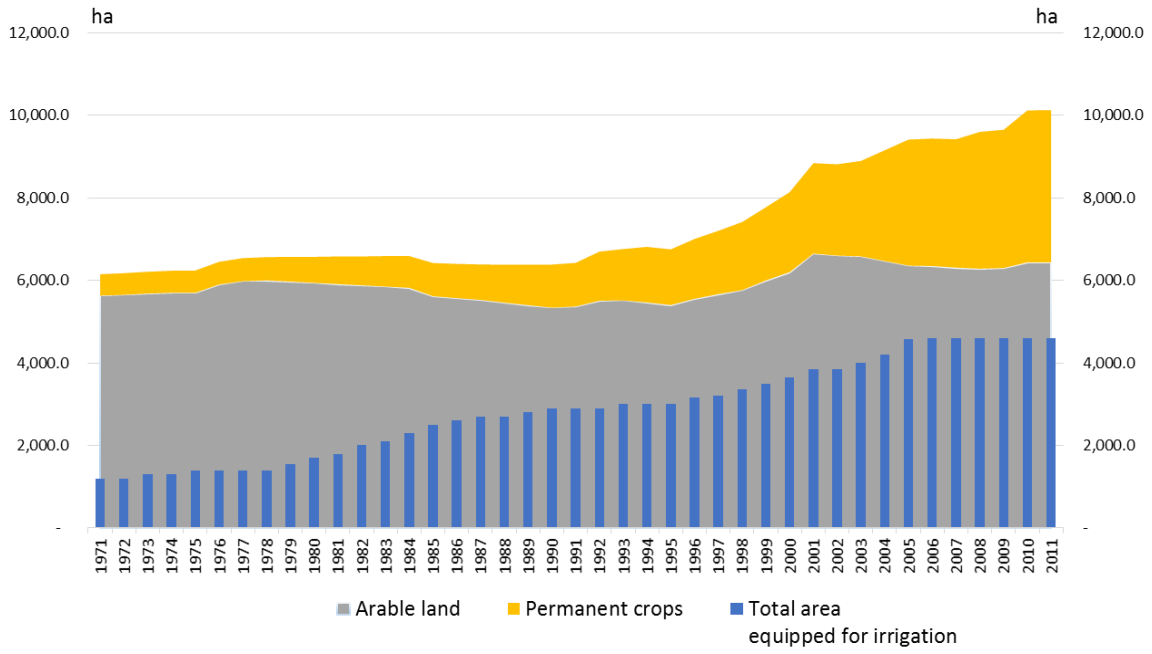
Source: AgroCensus 2001-2016 (GSO)

Figure 2.11: Annual growth rate for agricultural value added



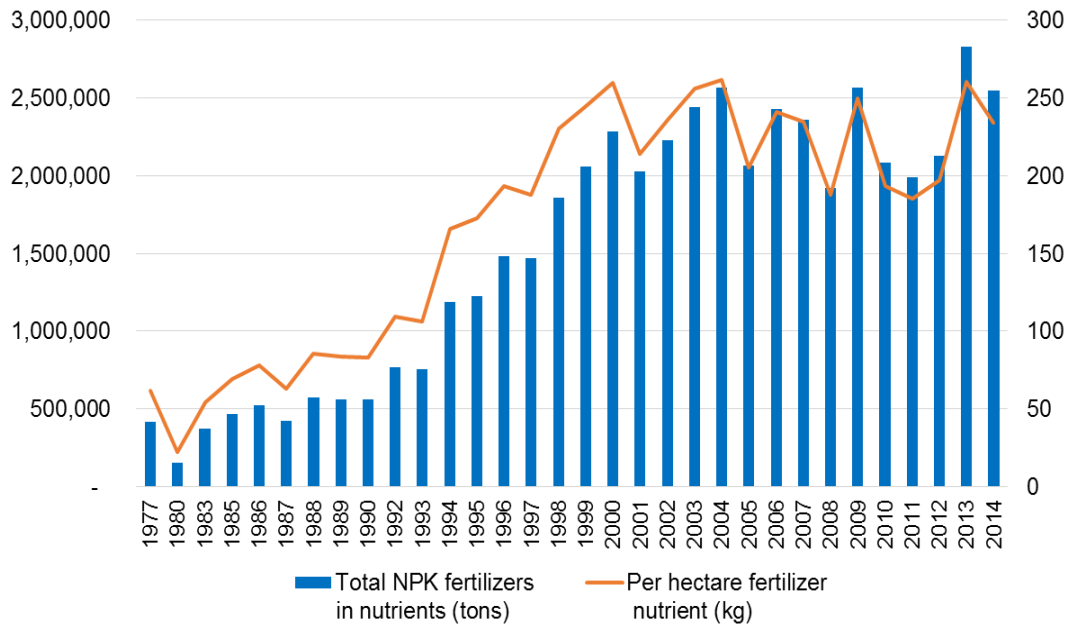
Source: Based on FaoStat, 2015

Figure 2.12: Agricultural land in Vietnam: arable land, permanent land and irrigated land (1971-2011)



Source: Based on FaoStat, 2015

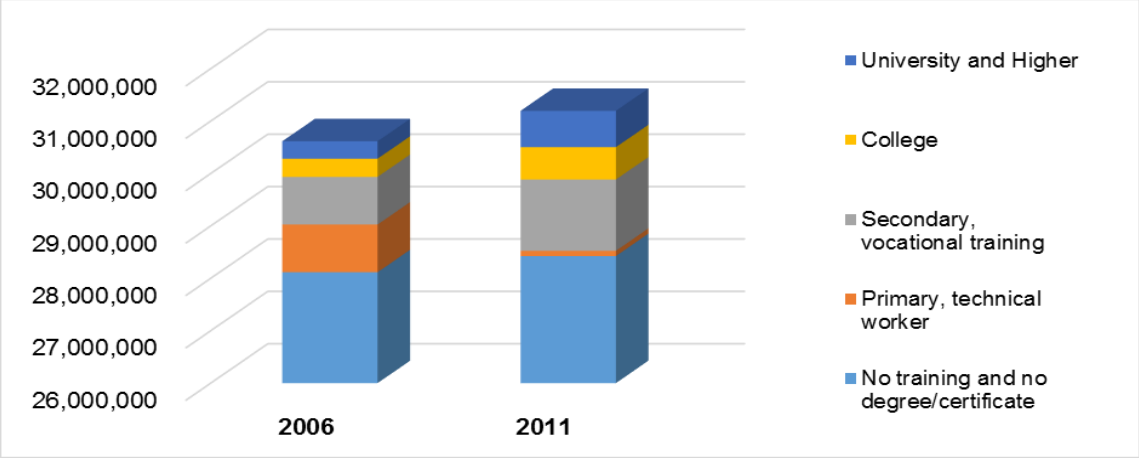
Figure 2.13: Fertilizer use (1977 – 2014)



Total NPK fertilizer nutrients (in tons) are computed from: nitrogen fertilizers (N total nutrients), phosphate fertilizers (P205 nutrients) and potash fertilizers (K20 total nutrients). Data from 1977 to 2007 are retrieved from GSO and MARD statistics. Data from 2008 to 2014 are retrieved from FAOStat 2015.

Per hectare fertilizer nutrients (kg/ha) are obtained by dividing total NPK fertilizer nutrients to the agricultural land.

Figure 2.14: Rural active population by qualifications



Source: Agro Census 2006, 2011 (GSO)

Appendix 6: Data Sheet – Livestock Sector

Figure 2.15: Livestock units by species (1970 – 2014)

Data source: Data on herd population: 1970 – 2000 (FAOStat, 2015); 2001 – 2014 (Strategy for Restructuring Livestock sector, DLP, 2014). **LU:** Livestock units. Conversion parameter (FAO 2005): Cattle (0.65); Buffalos (0.70); Sheep, Goats (0.10); Pigs (0.25); Poultry (0.01).

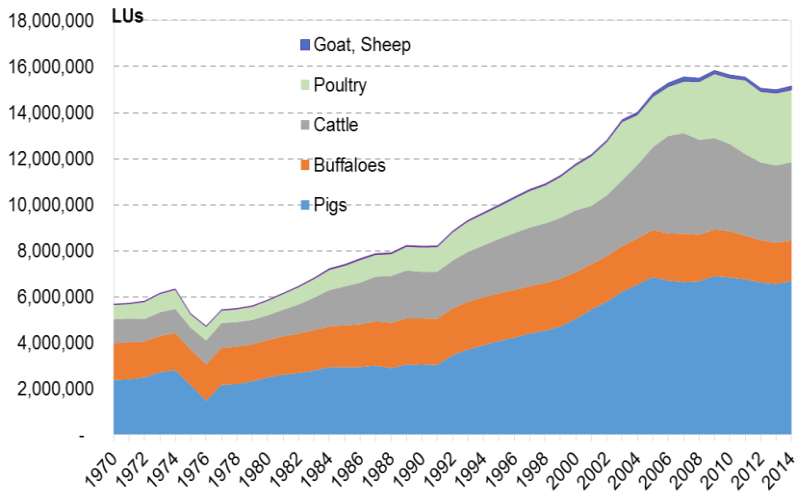
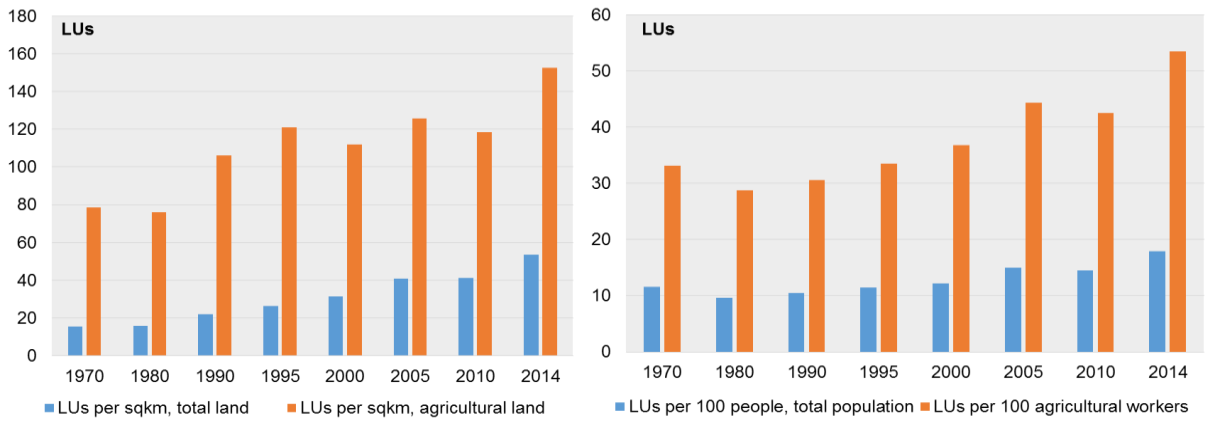


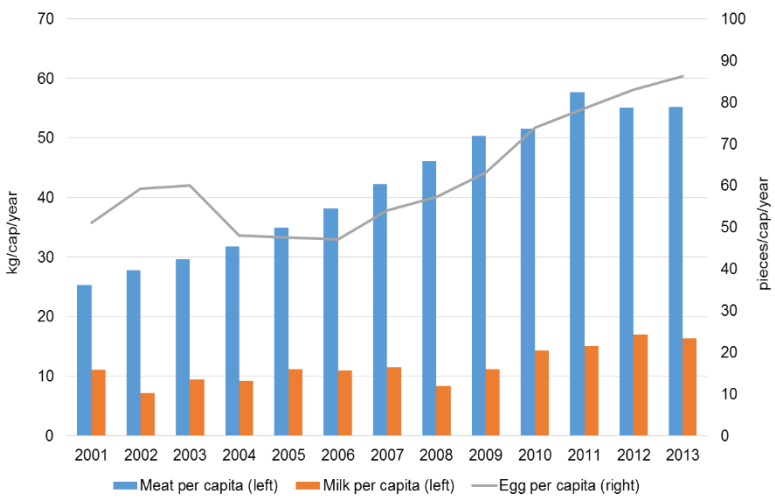
Figure 2.16: Density indicators of livestock resources



Source: Data on herd population: 1970 – 1989 (FAOStat, 2015); 1990 – 2014 (GSO, 2015). **LU:** Livestock units. Conversion parameter (FAO 2005): Cattle (0.65); Buffalos (0.70); Sheep, Goats (0.10); Pigs (0.25); Poultry (0.01).

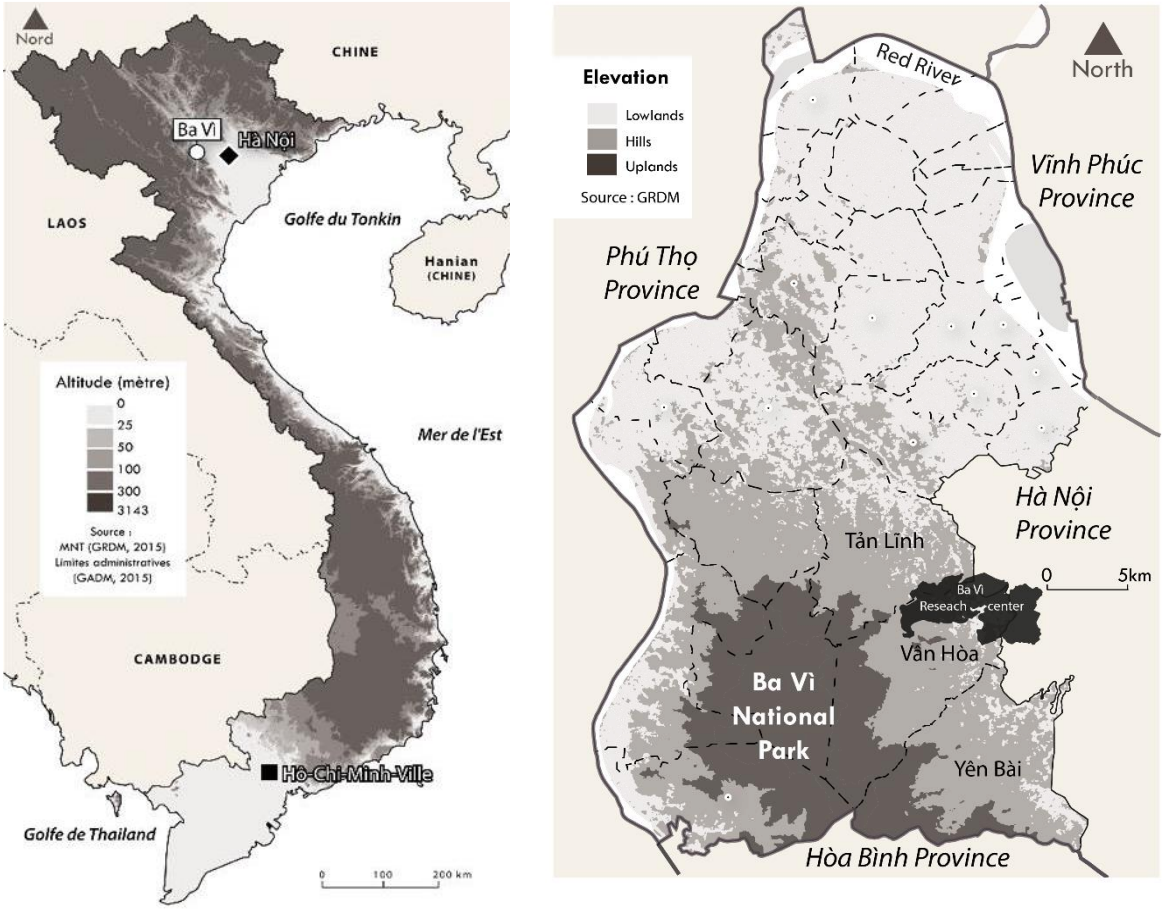
Figure 2.17: Supply of livestock product per capita (2001-2013)

Source: Livestock development strategy (DLP/MARD, 2014)



Appendix 7: Data Sheet – Ba Vi District

Figure 2.18: Landscape Map of Ba Vi district



Source: Cesaro, 2015

Table 2.7: Landscape of Ba Vi district

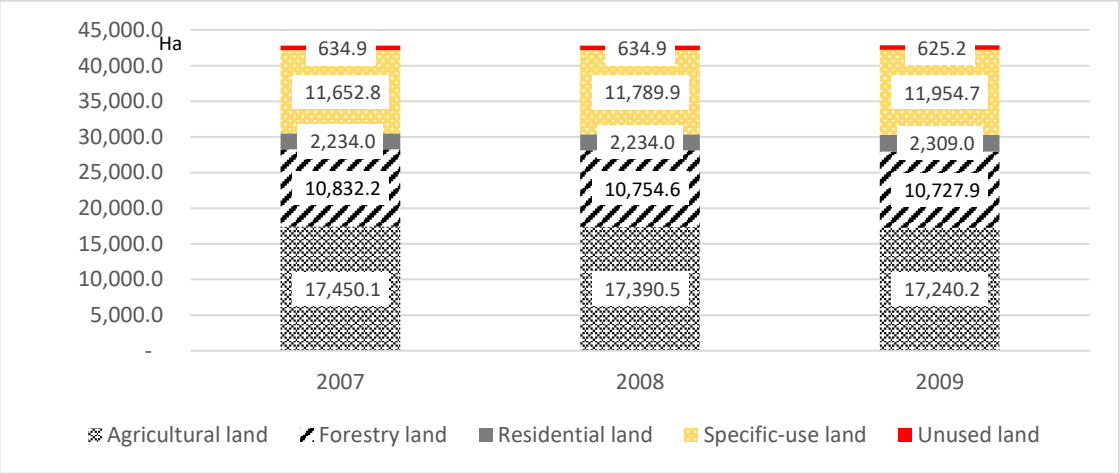
Zone	Upland	Hilly zone	Lowland zone
Administrative coverage	7 communes (including Ba Vi national park)	13 communes	11 communes
Share of natural land	47.5%	33.62%	18.88%
Share of agricultural land	20%	54.9%	37.84%

Table 2.8: Agricultural land availability in Ba Vi

	2007	2008	2009	2010	2011	2012	2013
Agricultural land per agricultural HH (ha)	0.37	0.38	0.39	0.42	0.407	0.422	0.433
Agricultural land per agricultural worker (ha)	0.17	0.18	0.18	0.18	0.180	0.182	0.187

Source: Economics Division, DPC of Ba Vi district (Ba-Vi DPC 2014)

Figure 2.19: Land patterns in Ba Vi (2007-2009)



Source: Economic Department, DPC of Ba Vi (Ba-Vi DPC 2014)

After 30 years of economic reforms, Vietnam is still undergoing a transition phase. Beyond steady economic growth, the country is facing a deep structural transformation of its economy, resulting in a declining share of the agriculture in GDP and employment, associated with more significant contribution from industry and services. Structural changes also occur in the agricultural sector itself, deeply impacting the farming systems and the rural dynamics. This agricultural transformation includes changes in agricultural land use, higher inputs utilization and mechanization, new labor organization on farm (family or hired), growing nonfarm activities, farm concentration and growing farm sizes, technology adaptation, and diversification of agricultural activities (crops diversification, emergence of livestock production, etc.). The changes in the structure of livestock production, dubbed as 'livestock revolution' is underpinned by the major importance of smallholder farmers and by the recent (and rapid) emergence of medium- and large-size farms.

*The dairy sector is a typical example of this expansion of livestock production. The development trajectory of Ba-Vi district shows how the local dairy sector is shaped by global and local institutional changes (land reforms, cooperatives development, regional integration and globalization, but also local investments of private firms, involvement of local authorities). Beyond the farm-gate dynamics, further changes occur with the development of the value chains. The next chapter (**Chapter 3)** zooms on the structural changes and dynamics at territory level (district) and sector level (dairy sector) by exploring the local dairy value chain governance, i.e. understanding how local institutions, public and private organization, and private actors adapt to structural changes and to uncertainties of the global environment.*

CHAPTER 3

GOVERNANCE OF THE DAIRY SECTOR IN VIETNAM

© Photo credit: Mai Huong (2014-2016)

From left to right, top to down:

(1) Feeding cows in Ba Vi (cut-and-carry dairying system); (2) Collection station in Ba Vi; (3) IDP tank truck collect milk from a collection point in Tan Linh commune; (4) Packing milk cake at Ba Vi Milk Cake Company; (5) A milk boutique in the Ba Vi district; (6) UHT milk products of IDP

What shapes the governance of the dairy value chain in Vietnam? Insights from Ba-Vì milkshed (Hanoi Province)

Mai-Huong Nguyen [(a)], Guillaume Duteurtre [(b)], Paule Moustier [(c)]

[(a)] *RUDEC/ IPSARD, 16 Thuy Khue - Tay Ho - Hanoi - Vietnam. And CIRAD-MOISA, TAC9-15, 73 rue Jean-François Breton, 34398 Montpellier, France. maihuong.nguyen@ipsard.gov.vn*

[(b)] *CIRAD, UMR SELMET, TA C DIR/C Campus International de Baillarguet, 34398 Montpellier, France. duteurtre@cirad.fr*

[(c)] *CIRAD, UMR MOISA, TAC99-15, 73 rue Jean-François Breton, 34398 Montpellier Cedex 5, France. moustier@cirad.fr*

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Summary

Vietnam has experienced a rapid growth in the dairy sector since the early 2000s. However, the organization of the sector is said to be inequitable and its motivational mechanisms are not sufficient to ensure the development of smallholder farmers. To assess smallholders' prospects in the upgrading process of the whole dairy sector, we conducted a study in Ba-Vì district, the largest "milkshed" in the Red River Delta, which has undergone a remarkable transition from state-owned concentrated production to smallholder farms. The study focuses on value chain governance and upgrading strategies. The local dairy value chain is dominated by smallholders and characterized by contractual relations between private milk collectors and industrial, semi-industrial, and cottage processors. The local chain is featured by a mixed relational-captive governance pattern. Relational governance characterizes the two sub-channels in which small-scale industries operate. Captive governance describes the leading role of a medium-size dairy firm that has invested in UHT processing facilities and benefited from support from the local government. The strong role of public authorities and some challenges for chain upgrading are discussed.

Keywords: *dairy sector, value chain governance, livestock development, Vietnam*

Résumé

Le secteur laitier du Vietnam a connu une croissance extrêmement rapide dans le secteur laitier depuis le début des années 2000. Toutefois, plusieurs auteurs montrent que l'organisation du secteur laitier est inéquitable et que les mécanismes incitatifs sont insuffisants pour asseoir de manière durable le développement des petits producteurs. Pour évaluer les perspectives des petits producteurs dans le processus de «upgrading» de la chaîne de valeur laitière, une étude a été conduite dans le district de Ba-Vì, la plus grande zone de production laitière du delta de fleuve Rouge. Ce bassin laitier a connu une transition remarquable d'un système concentré autour d'une seule et unique ferme d'État à un système quasi exclusif de production laitière réalisée au sein des petites exploitations. L'étude se concentre sur la gouvernance de la chaîne de valeur et les stratégies de mise à niveau («upgrading»). La chaîne de valeur laitière locale est dominée par les petits producteurs et caractérisée par des relations contractuelles entre les centres de collecte privés et les laiteries industrielles, semi-industrielles et artisanales. L'organisation actuelle de la filière est caractérisée par un mode de gouvernance mixte « relationnel – captif ». La gouvernance relationnelle caractérise les deux sous-canaux où les petites laiteries opèrent. La gouvernance captive se caractérise par le pilotage d'une laiterie de taille moyenne qui a investi dans la technologie UHT et a bénéficié de l'appui du gouvernement local. Le rôle fort des autorités publiques et certains défis pour la mise à niveau de la chaîne sont discutés.

Mots-clés: *filière laitière, gouvernance des chaînes de valeur, développement de l'élevage, Vietnam*

1. Introduction

The economic reforms that began in Vietnam in 1986[50] affected agriculture and the whole agro-food sector through land allocation to individual farmers, liberalization of agricultural production, and the gradual privatization of state-owned enterprises (Son 2009). The agricultural GDP grew annually by 4.2% and by 3.5% in the periods of 1986-2004 and 2005-2013 respectively. The livestock sector has been particularly dynamic with an annual growth of 5.3% for the 2005-2013 period and, in 2014, represented 26.4% of agricultural GDP. Pig and poultry production accounted for 90% of livestock output (GSO 2014)[51] while milk production has increased significantly, both in terms of the national dairy herd and of the average milk yield. The dairy herd quintupled from 41,241 to 227,020 cows between 2001 and 2014, mainly on smallholder farms. During the same period, milk production augmented from 64,703 to 549,533 tons (DLP 2014)[52]. Economic growth induced higher demand while enabling environment favored an increase in both milk production and consumption[53]. National policies were promulgated to encourage the dairy sector, such as the Decision 167[54] supporting dairy development for the 2001-2010 period with a focus on smallholder production. In 2011, 90% of all dairy cows were raised on small farms of less than 20 cows. Larger dairy farms were formed out of partially and progressively privatized state agro-forestry farms (FCV 2011).

Despite these improvements, the dairy industry only satisfies 30% of domestic demand (DLP 2014), and the remaining demand is covered by imported milk powder and dairy products worth US$1,097 million in 2014 (Vietnam Customs 2015). The new livestock development policy (2014)[55] gives priority to the development of large commercial farms. While some authors report efforts by large dairy corporations to exclude small-scale vendors and family farms from value chains in developing countries (GRAIN 2011), others highlight the complementarity between firm-led governance and contracted smallholder farmers (Humphrey and Memodovic 2006).

This paper aims at characterizing the governance pattern of the local dairy value chain, and linking the governance to the economic performance and development of the chain. The respective roles of private firms and of government in value chain governance are

[50] The '*Đổi Mới*' (Renovation) has moved Vietnam away from a centrally-planned economy to a "socialist-oriented market economy"
[51] General Statistics Office
[52] Department of Livestock Production (under the Ministry of Agriculture and Rural Development (MARD))
[53] Per capita milk consumption increased from 3.7 liters in 1995 to 20 liters in 2013 (FaoStat, 2014)
[54] Decision 167/2001/QD-TTg of the Prime Minister (26th October 2001)
[55] MARD's Decision n°984/QD-BNN-CN (2014) approving the "Restructuration of the livestock sector towards improvement of added value and sustainable development"

explored to assess current upgrading trajectories and future prospects for smallholder dairy production.

2. Materials and Method

2.1. Value chain governance and determinants of governance patterns: an integrated approach

The emergence of governance in economics is linked to integration of international trade and disintegration of production (Feenstra 1998). As production is increasingly fragmented across geographical space and between firms, many studies focus on how these fragmentations are coordinated and exchanged (Gereffi et al. 2005). While some economists see market coordination in governance patterns, Humphrey and Schmitz (2000) refer to governance as any coordination of economic activities "through non-market relationships". This relates to various ways of steering activities that are embedded in value chains, not only networks but also more hierarchical forms. Between the two extremes of market and hierarchical governance, three governance modes are identified: "modular", "relational" and "captive" (Gereffi et al. 2005). In these three governance modes, lead firms exert their power by coordinating production vis-à-vis suppliers without direct ownership of the firms. In agribusiness value chains, such patterns include out-grower schemes, contract farming, category management by supermarket suppliers, marketing contracts, and farmer cooperatives (Humphrey and Memodovic 2006; Moustier 2010). These forms of coordination influence the costs of governance through their effects on the complexity of transactions, the codifiability of transactions, and the capabilities of the suppliers required for a specific transaction.

The global value chain approach (GVC) draws on Transaction Cost Economics (TCE) and Network theories, while focusing on the internal logics of sectors, such as industrial structure and production-process characteristics (Bair 2005). The TCE framework provides insights into the factors that determine value chain governance patterns by convening the effect of transaction characteristics (asset specificity, uncertainty and transaction frequency) and the associated transaction costs (both ex-ante and ex-post costs of contracting) (Williamson 1979). This approach argues that increases in uncertainty and the risks of opportunism result in greater use of complex contracts or vertical integration (Williamson 1991). Complementarily, Network theorists propound that problems as contractual hazards need to be managed at the inter-firm level through social mechanisms, *i.e.* trust, trustworthiness, reputation, norms, mutual dependence and information exchange (Powell 1989; Jones et al. 1997) that are called 'mundane'

transaction costs (Gereffi et al. 2005). Institutional economists also suggest that such formal and informal institutions are "embedded" in their cultural and social environment. Hence, they underline historical processes and path-dependency by which specific institutional arrangements emerge in a given context (North 1990). Different forms of social embeddedness raised by network theory refer to the concept of 'proximity' which valorizes the response to market demand of arrangements and connections among actors engaged in the value chain (Moustier 2012). Recent literature highlights three levels of proximity: physical proximity (Gilly and Torre 2000), organizational proximity (Torre 2000), and functional proximity (Gereffi et al. 2005).

Governance arises when "*some firms in the chain work to parameters set by others*" (Humphrey 2005). A lead producer or a lead buyer play an important role in setting and enforcing parameters (product, process, logistic parameters) because they have a strong position in "core nodes" of the chain that allows them to extract different types of rents (Gereffi 2001; Humphrey and Schmitz 2002). The "captain" of the chain can be identified by key indicators: (i) share of chain sales, value added, and profits; (ii) relative rate of profit; (iii) share of chain buying power; (iv) control over key technology; (v) holder of distinctive competence; and (vi) holder of chain "market identity" (brand-name) (Kaplinsky and Morris 2012).

The GVC framework, which has mostly been used for international chains, puts forward that increasing demand for quality and competition between firms translate into a shift from market to captive governance, driven by processing and retailing firms. From the literature on milk chains in emerging economies, it is hypothesized that milk chains tend to be steered by processing firms that place large-scale investments in processing and quality control, and develop contracts with farmers, those are provided with intermediate goods and technical assistance, in exchange of commitments to deliver milk. This has been evidenced in Brazil, Chile and Argentina (Reardon and Berdegué 2002); Bulgaria, Romania and Slovakia (Dries et al. 2009); India (Birthal et al. 2009). The governance of chains through contracts can be described as modular or captive depending on the asymmetry of power between suppliers and buyers and the strictness of contracts. In India, cooperatives facilitate farmers' access to services and markets, that somehow balances the power of industrial plants (Upadhyay and Ranjan 2007). In the quoted studies, contracted farmers benefit from higher profits and prices thanks to quality premiums. Public and private standards and services are described as complementary. In the paper, we consider if similar trends are observed in Vietnam through variables characterizing the governance (Table 3.1). We also assess the main economic results of

the chain and ongoing upgrading strategies. Finally, our discussion of the role of public services contributes to the debate on livestock development policies.

Table 3.1: Variables to be analyzed in value chain governance

Variables	Governance pattern				
	Market	Modular	Relational	Captive	Hierarchy
Term of the relation	Short-term orientation	Medium/ Long - term orientation	Long-term orientation	Long-term orientation	Long-term orientation
Information exchange	Limited	Frequent	Frequent	Frequent and idiosyncratic	Frequent and idiosyncratic
Enforcement mechanism	Price	Standards and information	Social embeddedness	Parameters set by lead firm	Parameters set by lead firm
Dependence level	Independent	Inter- dependent	Inter-dependent	Inter-dependent	Dependent
Power asymmetry	No	Low	Low	High	High
Physical proximity	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Organizational proximity	Yes/No	Yes/No	Yes	Yes/No	Yes/No
Functional proximity	Yes/No	Yes/No	Yes/No	Yes/No	Yes
Captain of the chain	Upstream/ Intermediate/ Downstream/ No captain	Upstream/ Intermediate/ Downstream/ No captain	Upstream/ Intermediate/ Downstream/ No captain	Upstream/ Intermediate/ Downstream/ No captain	Parent firm
Complexity of transaction	Low	High	High	High	High
Codification of information	High	High	Low	High	Low
Competence of suppliers	High	High	High	Low	Low

Source: Authors' synthesis adapted from TCE, Network Theory and the CGV approach

2.2. Study zone

Ba-Vì district, located 60km from Hanoi center (Figure 3.1), is the largest milkshed in the Red River Delta and includes a cluster of small farms that typically supply both regional and local markets (Hostiou et al. 2012). The dairy farms are mostly smallholding with fewer than 10 cows fed with less than 1 hectare of elephant grass, corn, or other forage. In 2014, the district dairy herd numbered 8,871 cows for a total milk production of nearly 30,000 tons (Figure 3.2). The development of smallholder dairying contributes to improved rural livelihoods through income generation, employment opportunities and better nutrition (Nguyen et al. 2013). However, the presence of industrial dairy processing companies, which have made well-targeted investments in the dairy chain, and cottage industry raises concerns about the effective and sustainable governance of the local

value chain (Duteurtre et al. 2015). The roles of public services and private firms in sustaining transactions and linkages between actors are thus of particular attention in this paper.

Figure 3.1: Map of study site

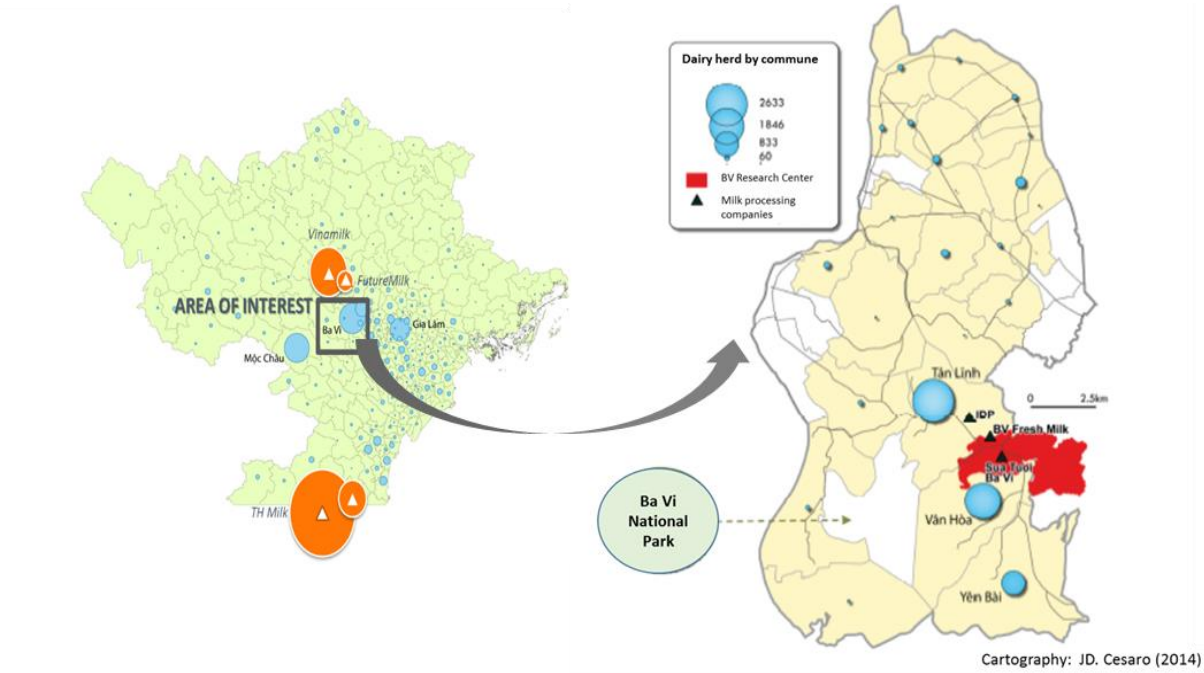
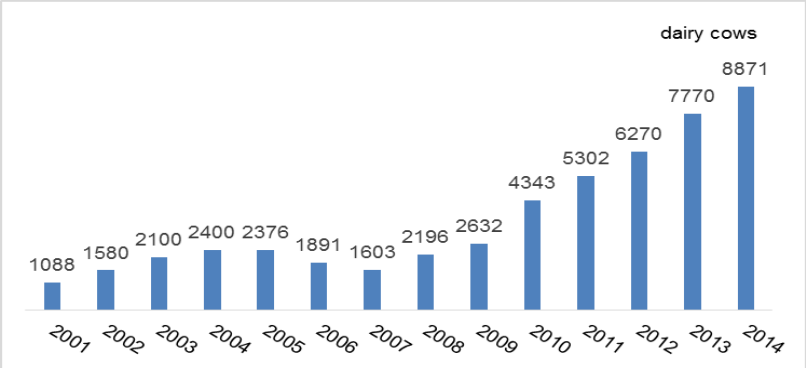


Figure 3.2: Increase in the dairy cow herd in Ba-Vì



Source: Economic Division, Ba-Vì district, 2014

2.3. Data and analysis

The secondary data (socio-economic, agriculture, etc.) from the target district and communes were collected to picture the local dairy sector. We mapped the dairy channels using the value chain scoping exercise developed by ILRI (ILRI 2014) and focused on the three communes of Tản-Lĩnh, Vân-Hòa and Yên-Bài, which together represent 80% of the milk production in the district. Seventy people involved in dairy

production and marketing in Ba-Vì were invited to focus-group discussions. Three main channels were identified corresponding to three types of processing: artisanal, small-scale, and large-scale.

An in-depth survey was sequenced in September 2014 (50 interviewees) and September 2015 (20 interviewees) comprising semi-structured interviews with different actors in the local chain (local authorities, 5 input and service suppliers, 21 producers, 9 collectors, 5 processors, 10 milk shops and 15 consumers) to characterize the value chain and scrutinize sustainability of the value chain. Given this small sample, the study should be considered as exploratory and the results have to be supported by a quantitative survey. Yet, some representativeness was sought in targeted interviewees according to their involvement in the three identified channels steered by the processors. Local actors were questioned about their business resources (assets, capital, know-how, labor, technology used), functions and activities (products purchased or sold, delivery and transport, services provided or received, access to credit, information exchange), economic results and management problems (prices of inputs and outputs, costs and margins, regulations, competition, strategy), relationship with other chain actors (contractual linkages, alliances, dependence, groups or associations, market relationships, information, power asymmetry, proximity), quality management (types of products, quality standards, payment schemes, quality labelling, certification), enabling environment and supports from local government (technical assistance, extension services, livestock insurance, etc.). Possible changes over time of these variables were collected to grasp the dynamics of the whole system. Downstream flows from milk production to milk processing to end-use activities were traced to identify the drivers of innovations and who received the largest share of the margins and value addition produced by the chain.

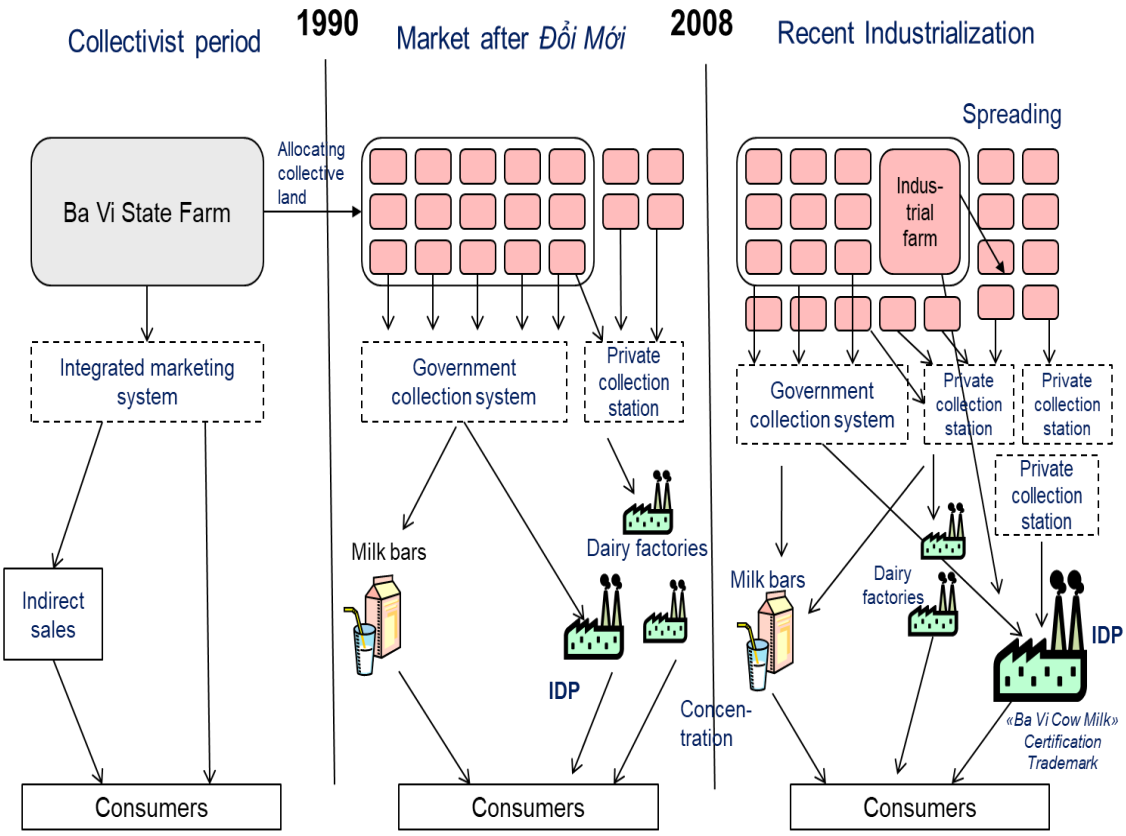
3. Results

3.1. The dairy development trajectory in Ba-Vì

Milk production started in Ba-Vì in the early 20th century. The development trajectories of Ba-Vì's dairy sector correspond with the national trends in the periodized political economy (Figure 3.3): milk production concentrated on State farms (during the collectivism period), milk production on individual smallholder farms (during the *Đổi Mới* period) (Suzuki et al. 2006), and industrialization of the private dairy sector (since 2008) (Duteurtre et al. 2015).

The recent industrialization shift of the local dairy production has turned out since the Government launched its 2020 livestock development strategy in 2008. In the same year, the melamine crisis caused by adulterated powder milk imported from China hit the local chain as some local firms had to suspend their milk collection and to stop their processing activities. Among the processing companies involved in the collection of local milk, only International Dairy Products Joint-Stock Company (IDP) and Bavi Milk JSC. (BVM) continued to buy fresh milk from local farmers, resulting in a concentration of the dairy industry. IDP built a new dairy processing plant (2010) next to Ba-Vì Cattle and Forage Research Center[56] (CFRC) in Tản-Lĩnh commune, and extended its collection network. These investments were further valorized and secured by a memorandum of understanding (MOU) between IDP and the district authorities. IDP then adopted a 2012-2020 dairy development program aiming at expanding local milk production through credit to farmers, improved breeding, new production techniques, supports for an industrial-scale "demonstration farm", and building an animal feed mill.

Figure 3.3: Dairy production development trajectories in Ba-Vì



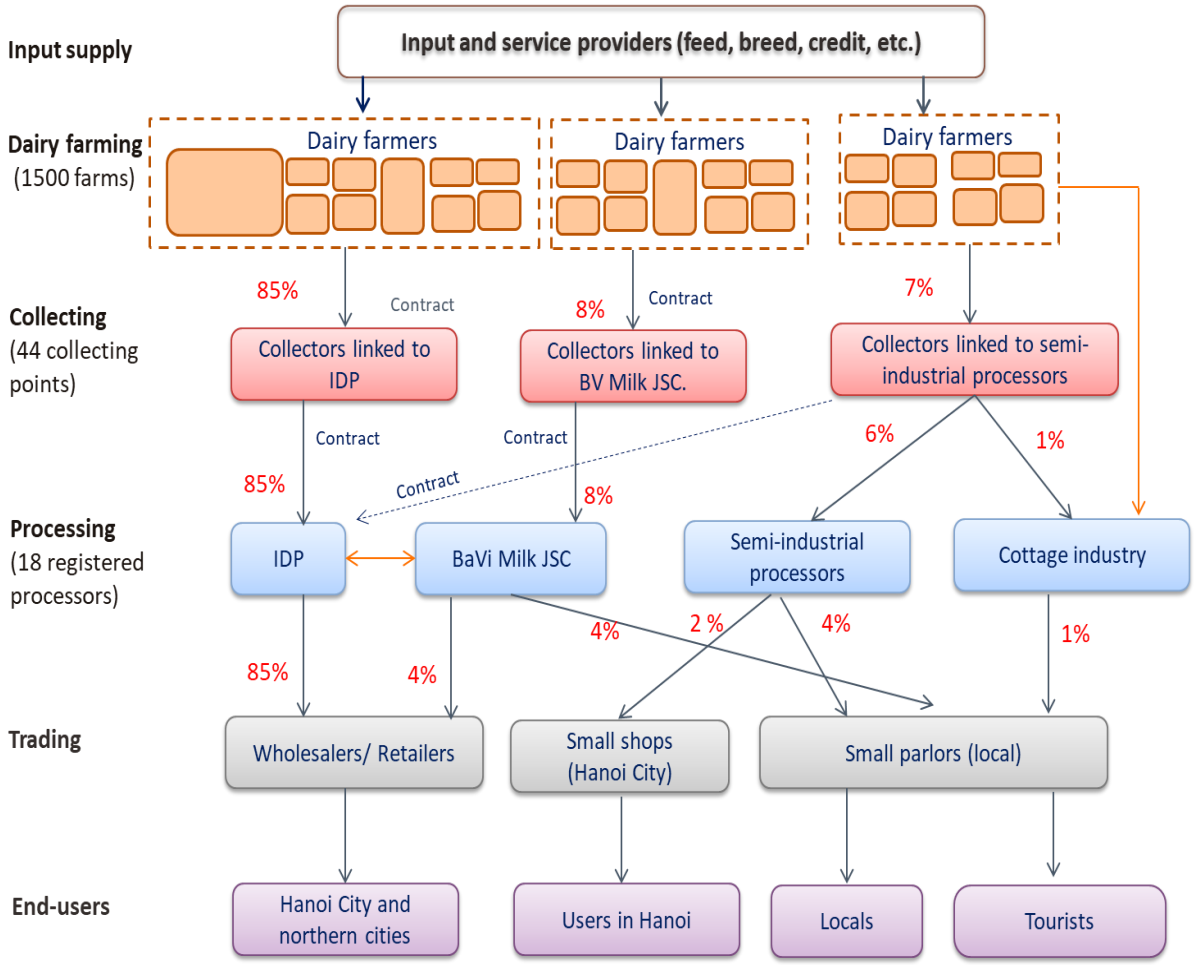
Source: Authors

[56] In 1989, Ba-Vì State farm was converted to Cattle and Forage Research Center with mandates to conduct research into cow breeding and feeding, animal health and reproduction, and forage cultivation

3.2. Characterization of the Ba-Vi dairy value chain

The Ba-Vi dairy value chain includes five segments: supply of inputs, milk production, milk collection, milk processing, and marketing and distribution of dairy products (Figure 3.4).

Figure 3.4: Ba-Vì dairy value chain



(Note: solid lines represent normative relationship; dash line illustrates non-regular relationship happening in winter when the surplus volume unabsorbed by semi-industrial processors (given their limited processing capacity) are sold to IDP)

Source: RUDEC's survey (Revalter, 2014-2015)

Input and service provision: Farmers have their inputs sourced from either self-supplied stock, mostly green fodder (representing about 50% of the farms' feed requirements), or external inputs purchased off-farm (industrial feed, artificial insemination, veterinary services, etc.). Beside the network of private veterinarians, local producers receive support from extension agents, who implement technical assistance programs launched by the local government and the Hanoi Livestock Development Center (HNLDC). The

women's union, the farmers' association, and private collectors initiate and contract credits to producers with funds from the IDP, commercial banks and (in the case of the associations) their own members' savings.

Dairy farming: Milk production in Ba-Vì is done on small farms of 0.5-1 hectare (Khanh et al. 2011). Regarding feed availability, a "typical" family farm with three dairy cows has around 3000m^2 (around 60% of its cultivated land) under forage crops. Both farms diversified in crop-livestock production and farms specialized in milk production target stable markets based on contracts with industrial and semi-industrial processors. Some rely on verbal agreements with small-scale processors and cottage industry, who generally buy milk on a less strict quality at higher price but at a very limited volume.

Milk collection: Collectors are crucial middlemen who greatly contribute to the organization of local milk production and marketing. The collection of fresh milk anchors on annual contracts or verbal agreements with fixed prices, or spot market exchanges. Out of 44 local collection points, IDP has the largest network (32 stations) and buy up 85% of total district outputs. Most collection stations belong to private collectors who are supported by the companies for credit access and the provision of equipment and know-how. All private collectors are part of the IDP milk payment scheme, which gives premium to high quality milk. The companies grade the milk delivered by producers through monthly quality analysis. The CFRC organizes its own collection network involving their contracted farmers[57] and then sells the milk to IDP. Semi-industrial processors also rely on collection points where they buy 6% of all the fresh milk produced locally. Business relations between producers and semi-industrial processors stand on verbal agreements through those collection points. Most of the collection points are located along main roads to reduce time spent on transport from farms to the processing plants.

Processing: Eighteen registered milk processors operate in Ba-Vì. However, 93% of the milk is processed by two industrial processors (IDP and BVM) who produce a wide range of industrial products. IDP is the only processor to use the UHT technology. Around 6% of the milk is processed by semi-industrial processors (Ba-Vì Milk Cake - BVMC, Ất-Thảo, Xuân-Mai, etc.), the rest is processed by small cottage processors. The semi-industrial and small processing units produce pasteurized milk, milk cakes, caramel cream, and yoghurts.

[57] CRFC's contracted farmers are those perform dairy activities based on rental leasing contracts. Some of their cows and all their land are leased from the CFRC.

Marketing and distribution of dairy products: Increasing income, rapid urbanization, changing diet habits have driven the increased milk consumption in Vietnam. The strong territorial identity of Ba-Vì (nature, tradition, culture, know-how) and quality label (certification trademark) spur the preference of consumers for Ba-Vì milk products. Industrialized products are sold by modern distribution (supermarkets, convenient stores) and shops mostly outside the district, particularly in Hanoi, whereas the semi-industrial and artisanal products are sold locally to tourists in small shops located along highways connecting Ba-Vì and Sơn-Tây town and to Ba-Vì national park.

Family farming is still secure thanks to major constraints on access to land and capital, which precludes the development of large industrial farms. Landless and labor-intensive milk production have allowed smallholders to stabilize their business and guarantee economic returns to family labor. Written contracts with milk collectors are underlined in controlling price fluctuations and enforcing contractual linkages between producers and processing companies.

3.3. The mixed governance pattern of the Ba-Vì dairy value chain

3.3.1. Importance of product characteristics in the governance of the local value chain

Coupled with the functional characteristics of chain actors, the technical properties of the milk products affect inter-firm relationships and governance patterns. First, the perishability of raw milk and unsterilized dairy products localizes collecting and processing facilities close to production areas. This perishability restricts marketing flexibility for farmers and traders but increases their marketing risks. Marketing fresh milk products is thus characterized by physical proximity and contractual relationships, whereas sterilized products can be sold very far away through market adjustments. Second, seasonal variation in milk production and consumption raises concerns about the adjustment of milk collection, processing and storage, and more generally about balancing supply and demand. This seasonality creates trading risks for farmers, puzzles cost-efficient utilization of labor and processing facilities and complicates the structure of products for processors. IDP upgraded its processing line to diversify its products and to handle the abundance of raw milk in the off-season and contracted to purchase surplus milk from external collection points of semi-industrial processors and cottage industry. The UHT line installed in 2010, which manufactures storable dairy products, plays a significant role in this respect. Third, although milk is a relatively homogeneous product, its nutrient content varies considerably among producers, upon cow breed, feeding, and

farm management practices. The heterogeneous quality requires significant investments and extra costs for grading, especially measuring the fat and dry matter content of the milk procured.

3.3.2. Relational governance: linkage between dairy farmers and collectors

The governance of the milk collection schemes is mainly relational. Linkages between farmers and collectors are defined by physical proximity, organizational proximity and functional proximity (Table 3.2).

Table 3.2: Characterization of transactions determining proximity between farmers and collectors

Type of proximity	Characteristics of transactions
Physical proximity	Distance between farmers and collection points is less than 2 km
Organizational proximity	Family relationships between producers and collectors Moral factors that shape mutual confidence
Functional proximity	Agreed sharing of collection areas between collectors (and processors)

Source: RUDEC's survey (Revalter, 2014-2015)

Besides the proximity of collecting points and milk producers, processing facilities have been built in the district to ensure just-in-time processing. Collection points of industrial processors are installed along the main roads to enable access by big tank trucks, whereas the collection points of semi-industrial processors settle farther away. While most of dairy farmers deliver their milk to the collection points within their village, some farmers fetch milk to collection points of another village because of social connections. The social proximity reduces uncertainties related to price, quality, and quantity while enables access to informal credit, information, and knowledge.

Collectors bridge farmers and companies through formal contracts. The bilateral contracts between farmers and processors refer to the collector's name and are signed at collector's place. As the collector is responsible for managing and enforcing the contracts, actors consider those contracts as "tri-party" agreements. Beside terms regulating rights and responsibilities of farmers and processors, the contract defines different tasks performed by the collector (delivering milk to the factory, sampling milk for quality test, proceeding payments, etc.). However, the one-year term implies contractual ties not being the only institution to ensure the regularity of milk delivery and the loyalty of the producers. There is always a risk that a farmer will switch from one collector to another when the contract ends. Thus, financial and moral aspects as well as interpersonal

proximity enforce the contract. Trust between farmers and collectors is sustained by other supports: credit at low interest rates to farmers to buy cows or to build facilities (VND 20-50 million[58] for a term of 6 to 12 months with extension possibility), or advances (VND 1-3 million) for the purchase of feed, which farmers can reimburse in milk. Since farmers find it difficult to access to formal credit provided by banks (due to the high interest rate, absence of mortgages or collateral assets such as Red Book[59]), financial support from collectors has largely contributed to the local dairy development. Connections between collectors and farmers hang on social principles and on events taking place in the villages and communes (weddings, funerals, house-warming, religious events, etc.). Milk collectors strengthen their relationship with farmers by buying milk of lower quality rejected by the processors (in this case, milk is bought at a lower price for feeding young calves), delivering veterinary services free of charge, providing technical assistance and information or giving bonuses for milk delivered. These incentives are regarded as tools for collectors' transactional assurance and improving milk quality (Saenger et al. 2013). Other attributes of relational governance are evidenced by frequent information exchanges between dairy farmers and milk collectors. Any changes in the policy or strategy of processing companies, or price fluctuations are passed to farmers by collectors. Milk collectors are obliged to invest their time and resources in building such networks, but they themselves benefit from relational governance in two ways: (i) it enables them to expand their input business (feed, animal medication); (ii) they are able to obtain necessary information to reduce risks connected with milk quality at farm level. The above-mentioned legal and social mechanism facilitates the symmetric relationship between dairy producers and collectors.

3.3.3. Captive governance: outstanding role of IDP as lead firm

Different from the informal link between farmers and cottage industry, mixed connection between farmers and semi-industrial processors, the relationship between farmers and IDP is formal. Facilitated by the MOU with the district authority (2009), IDP has a quasi-monopoly in purchasing local milk as IDP collects 85% of the milk locally produced and imposes purchase prices and the quality norms (dry matter content, fat content, antibiotics, etc.) that are a reference for the whole district. Semi-industrial processors organize their collection and price their purchases based on the price range defined by IDP. Both the pricing and the payment system (penalty, bonus, and quality standard) are decided by IDP without formal discussions with the farmers, who are in a weak position in

[58] Equivalent: US$1,000 - US$2,500

[59] "Red Book" is the Land Use Right Certificate delivered by local administration

the chain. Dairy farmers are not organized to benefit from collective actions, and are thus unable to exert power or negotiate the milk prices and other concerns. Dairy farmer groups are established in only three out of seventeen dairy farming communes. Except for technical training classes and visits to farmers, these groups don't have any collective activities (as bulk purchase of inputs) or action plan to dialogue and negotiate with the processors.

IDP drives the technological advances in local industry by investing in UHT technology. This investment allows IDP to produce pasteurized long-life milk, which helps balance supply and demand in winter, and target larger markets outside the district (i.e. Hanoi city and even Central and Southern provinces). Moreover, IDP has built up professional teams for the different stages (collection, processing and sale) to provide technical assistance to their farmers and collectors. Besides, IDP commits short-term and medium-term credit to the farmers linked to their network. While formal bank loans usually require collateral, informal loans and microfinance enable dairy farmers to purchase cows or make other investments.

IDP officializes its operations by contractual relationships with producers and private collectors aiming at securing supplies and reducing risks. The written contract system has been in use since IDP's debut in the region. Today, most local producers have a contractual link with a processor (large or small, industrial or semi-industrial), although a small number of producers supply their milk to cottage industry without written contracts. Under the contract terms, together with technical aspects, hygiene requirements, and respecting sanitary norms, IDP agrees to buy all milk that meets quality criteria. The penalty and bonus policy is also defined by quality attributes. IDP encourages farmers to produce quality milk by offering premiums tied to the milk quality and quantity. Other bonuses are awarded for respecting the code of practice (certified by IDP), use of tanks and equipment for transporting milk, and compliance with farm sanitary standards. A stable year-round purchase price discourages farmers from switching to another processor. Although the prices set by IDP are somewhat lower than cottage industry on spot market, farmers appreciate selling to IDP because of regular milk purchase during year. Along with the quality-based payment, IDP frequently monitors compliance of its contracted farmers with hygienic and farming practices. Captive governance led by IDP, on the one hand, has contributed to the rapid adoption of the Code of practice at the farm level and, in turn, to the company's success in creating a stable source of raw material for its large-scale processing. On the other hand, under this governance pattern, by founding a decentralized collection network, IDP aims at reducing its transaction costs (particularly

search, screening and transfer costs) since third-party collectors take over coordinating exchanges with small farmers. Yet, the costs of monitoring and enforcing the contracts with dairy farmers, in particular supervision of husbandry practices and control of milk quality, are still relatively high since most local producers are smallholders spreading out over a large area.

The milk chain is therefore characterized by a two-facet governance (Table 3.3): relational governance between farmers and collectors, and captive governance between farmers and IDP, the industrial processing firm.

Table 3.3: Specifications of governance patterns in the local dairy value chain

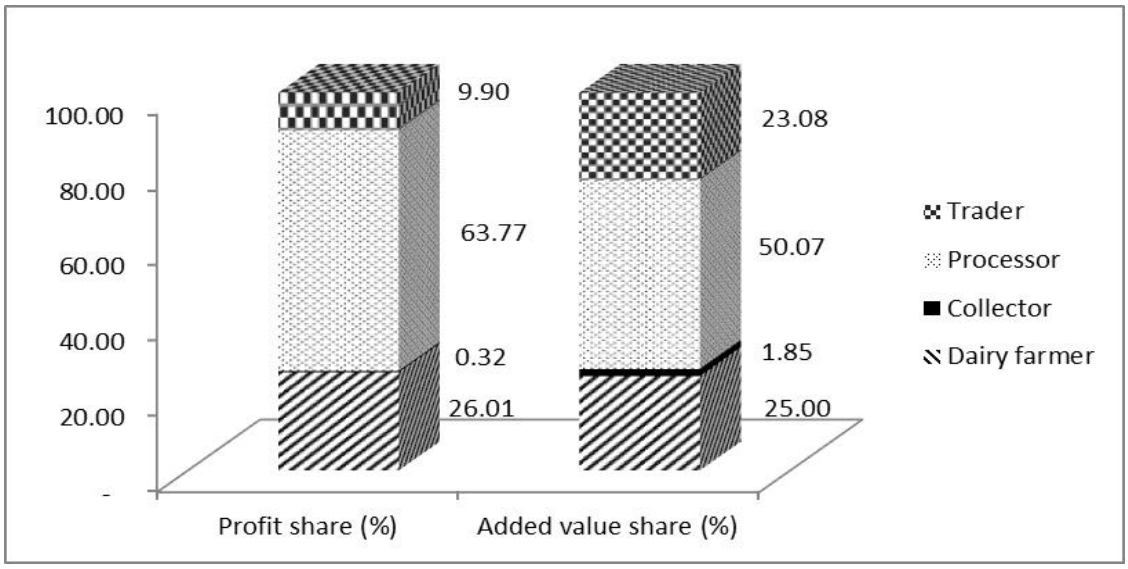
Variables	Relational Governance	Captive Governance
Term of relation	Long-term orientation	Long-term orientation
Information exchange	Frequent information exchange between producers and collectors (at collecting points, social events, etc.)	The connection between dairy farmers and processing companies is created and maintained by a network of collectors
Enforcement mechanism	Social relations between dairy farmers and collectors are driven by relational linkage, mutual trust	The terms and conditions in the contract between dairy farmers and processing companies concern the milk that is purchased and processed
Dependence level	Inter-dependence of farmers and collectors	Inter-dependence of collectors and processors (processing companies)
Power asymmetry	Relatively balanced/symmetric partnership between farmers and collectors	Farmers are highly dependent on processing companies who decide on the required milk quality and purchase price.
Captain of the chain	IDP	IDP
Complexity of the transaction	Tri-party milk procurement contract	Tri-party milk procurement contract
Codification of information	Norms and standards to ensure the quality of milk to be collected and processed	Norms and standards to ensure the quality of milk to be collected and processed Certification trademarks are granted to 2 local processors (IDP and BVM)
Competences of suppliers	Improvement in technical knowledge and economic situation thanks to training and credit	Improvement in technical knowledge and economic situation thanks to training and credit

Source: RUDEC's survey (Revalter, 2014-2015)

3.4. Economic performance of the value chain

Economic returns for chain stakeholders reflect chain operations and forms of governance. The unequal distribution of the profit and value added highlights the supremacy of processors, especially IDP, in the local dairy chain (Figure 3.5). IDP takes the largest share (63.77%) of the profit, whereas farmers receive less than one-third (26.01%) of the total profit made in the chain, which is disproportionate with respect to their investment costs (which account for up to 50% expenses of the chain as a whole). The dairy value chain is a typical chain in which the processors lead the chain forward, and the majority of added value of the chain is subsequently captured by processors like IDP. This asymmetric distribution has weakened the bargaining power of the dairy farmers. It is prevailing that all investments made by the processors (even small) are counted in their production costs and value addition. On the contrary, family labor, self-supply of grass for feed, and opportunity costs are neglected in earnings obtained by the farmers. If all costs were included, the added value gained by dairy farmers in the chain would be significantly lower. This unequal distribution proves the captive governance led by IDP, but raises concerns about the sustainable development of the dairy sector in general and of the dairy chain in Ba-Vì in particular.

Figure 3.5: Distribution of profit and added value among actors in the dairy value chain



Source: RUDEC's survey (Revalter, 2014-2015)

3.5. Enabling environment: the role of public services in value chain governance

Following the National Dairy Development Plan (2001), a number of research and scientific efforts were made in the dairy sector with the participation of international development actors. CFRC strengthened its research activities through government funds and international research and development (R&D) projects (JICA-funded dairy projects, Vietnam-Belgium Dairy project, the establishment of Moncada frozen semen centre, etc.). The international R&D projects built capacity for the local farmers and collectors as well as empowered the CFRC and contributed to transform its role from production development to the scientific research and technical consulting.

The dairy production in Ba-Vì is high on the agenda of Hanoi's rural and agricultural development strategy. Many actions have been done to support all the chain actors. CFRC land was allocated to former state farm workers to raise dairy cows. A long-term land lease was granted to IDP for its investment in the large-scale farm and processing plant. Technical assistance has been provided through extension programs delivered by CFRC, HNLDC, and IDP to farmers (concerning farming practices such as animal care, feeding, heat-stress control, etc.). Around 100 training courses were provided to 7,000 farmers between 2000 and 2014. Furthermore, the local government also cares genuinely for the territorial identity of Ba-Vì milk by applying for certification mark "Ba-Vì cow milk", in 2009, as intellectual property rights protection. The district government's control over the certification mark aims at maintaining the quality and reputation of Ba-Vì milk; but reserving the mark rights for only two companies (IDP and BVM) may prevent other companies who are qualified from obtaining the certification mark and, to some extent, ensures IDP's monopoly on collecting milk locally as IDP and BVM have partially merged.

Since 2012, the district dairy development strategy appears to be closely linked with the IDP development plan. Beyond the use of certification mark, the district government supports IDP in many institutionalized operations in the 5-year MOU. Together with the government's favorable policies (agricultural insurance for producers[60], favorable loans and taxation regimes, etc.), the district administration controls the entrance of other dairy companies by gauging daily collection capacity of minimum 600kg for placing collection points. This structural mechanism endeavors to a stable supply of milk to IDP and BVM.

[60] The State provides grants to cover the insurance fees: 100% of insurance fees for poor farmers, 80% for quasi-poor farmers, 60% for non-poor farmers, and 20% for cooperative groups (who are part of a pilot project on livestock insurance).

4. Discussion and Conclusion

4.1. Structural transformation and organization of the value chain

As a snapshot of national dairy sector which has been experiencing a rise of medium and large farms, Ba-Vì district, in the 2010-2014 period, witnessed a relevant change in farm size: decreasing number of small farms of 1-5 cows (from 89.55% to 61.17%), and increase in number of farms of more than 5 cows (farms of 6-9 cows: from 8.14% to 32.17%; farms of more than 9 cows: from 2.31% to 6.66%). Priority is given to the medium and large farms in view of higher economic returns, better epidemic and quality control and improved effluence management.

Despite the rapid structural changes in parts of the sector, smallholders till dominate dairy production. Low entry barriers to production are set by both dairy processors and local government to ensure smallholder farmers access to credit, public services (extension and veterinary services), and training as well as improved infrastructure. Higher barriers concern land constraints, dependence on concentrates, demanding quality standards and permanent contracts with companies. Smallholder production shows more resilient against market fluctuations, but it is difficult to generate sufficient volume to meet increasing demand and face higher competition from imported milk products. Accordingly, a niche marketing seems to be an important opportunity that help Ba-Vì milk overcome barriers to trade (special demand for fresh milk, quality local product, local market for tourists, restaurants, etc.). Increasing domestic demand and improved roads would facilitate sale of the products in the urban markets. Besides, technology is highlighted in transforming the chain and shaping the value chain governance (crossbred cows, new technology, and market dynamics such as prices).

4.2. Governance structure and upgrading strategy

The governance of the value chain relies on very complex social networks including dairy producers, collectors, processors, and public authorities, and resulting from long historical processes. Informal relations play a crucial role alongside formal contracts in this regulation (Culas and Pannier 2014). Although IDP makes contracts with farmers and defines quality standards and prices (which are attributed to captive governance), collectors are a key node between farmers and IDP, and the link between farmers and collectors is embraced by relational governance. Captive governance emerges in relation with large-scale investments by IDP and quality management objectives. Despite IDP's attempts to introduce strong vertical coordination of the local chain, private collectors

have been able to maintain their position and keep some power in their relations with dairy farmers. Like dairy production in Son-La province, Ba-Vì dairy farmers suffer from a very weak professional organization, meaning they have very little bargaining power to negotiate the prices dictated by IDP (Bui et al. 2013; Nguyen et al. 2013). Hence, captive governance is parallel with chain upgrading, but it translates into an asymmetric sharing of incomes. Yet our data is lacking to assess whether contracted farmers earn more or less income than non-contracted ones, in particular through coercive measures on quality.

The investments made by IDP have had a major impact on the upgrading trajectory of the local value chain. Among the upgrading dimensions, vertical integration and upgrading of both processes and products appear to be the most significant changes. The capacity of IDP to invest in farmers' development projects and in UHT processing technology has provided new opportunities and value addition for farmers and for other small-scale processors, through improved processing and packaging. The future of processing firms may depend on their capacity to set up contracts with appropriate incentives. The role of the authorities in managing the Ba-Vì certification trademark and milk quality control will certainly affect success chances of semi-industrial processing plants in the future.

While the problems of melamine contamination in China are linked to the rapid and unregulated development of the sector (Pei et al. 2011), a weak cooperation of firms in the Vietnamese fast-growing dairy sector has led to new challenges and compromised the ability of the value chain to maintain the viable link among actors and food safety. The different forms of local collective organizations (the processor federation initiated by IDP, BVM and BVMC in 2013 to guarantee the quality of local dairy products, to protect the interest of those concerns and to reduce risks; association of 14 collectors in Tản-Lĩnh commune established in 2013 aiming at mutual aid, strengthened solidarity, and limited competition among collectors) have no operational protocol to undertake their mission in reality. Meanwhile, the dairy farmer groups cannot perform collective actions. A national dairy management board encompassing different stakeholder representatives (producers, processors, state and consumers) is recommended to improve coordination between local actors and to handle all emerging issues and conflicts of the value chain.

4.3. Value chain governance and territory governance

As Vinamilk, the biggest milk company in Vietnam, IDP and BVM rely on large supply network of smallholder farmers and intermediary collectors within a milkshed where milk is collected into a tank mixing milk from different producers. Bimonthly payment to

farmers for delivered milk bases on the quality test done by the companies, while collectors receive a collection fee. The current decentralized collection system is beneficial to processors by reducing their investment, but is argued unfair and untransparent by both farmers and collectors since milk tests are done at the dairy plants and they have to accept the results and prices published by the companies. Such quality and payment system crystalize the tensions between farmers and processors; thus, an independent quality test agency is crucial in stabilizing the dairy zone.

Dairy smallholders in Ba-Vi, like in other milksheds in Vietnam and other countries in the South, are facing challenges related to strengthened health regulations and increasing resource competition among operators that weakens the participation of small producers in the market. Innovations in the dairy industry, such as conception of new products manufactured in the territory (cheese for example), will allow small producers and processors to have easier market access, to diversify their products and to increase their revenues. This would also help to meet other issues such as addressing seasonal fluctuations of milk products, lower costs to food, or the improvement of the quality of milk.

The recent strategy for eco-tourism development of Hanoi to 2020-2030 opens opportunities and challenges to the sustainable development of the dairy chain. From economic perspective, a fashion trend would be to create more diversity in dairy products and tours integrated with homestay at and visit to dairy farms. Community eco-tourism contributes to higher income for the locals. From social perspective, with a strong territorial identity, the local chain should involve more the local farmers and artisanal and small processors. From environmental perspective, for the non-grazing dairy system characterized by the confinement of animals, attention should be paid to effluence management and sustainable development of the territory.

The current certification trademark has contributed to the higher price of the local milk in the market. However, the upgrading to protected geographical indication (PGI) would be strategic in view of a stronger quality label as an integral attribute to the sustainability of the products in the market. Plus, PGI strategy will further valorize local natural resources, local know-how and the proactive participation of territorial organizations and actors to the sustainable and inclusive development

4.4. Institutional framework and enabling environment

Reardon et al. (2012) argued that the dynamics of the food chain in Asia is driven by economic development and public actions. Public services contribute to the upgrading and modernization of the value chain. The MOU between IDP and district government (2009) and the processing plant built by IDP on the land of CFRC are outstanding examples of public-private partnership in the agri-food sector. The Livestock Restructuring Plan (2014) converges with the Livestock Development Strategy (2008) in orienting the focus of dairy production in traditional regions, including Ba-Vì. Apart from controlling imports of milk powder and milk prices, the support provided by the State (technical assistance, credit, and building infrastructure) incentivizes dairy production, improves market connections and promotes market integration. At the provincial and district levels, strong local government involvement is apparent in economic, technical, organizational and other angles. However, the definition of quality is not shared by all the actors in the chain.

Dairy industry, as a component of livestock sector is proved to be negatively affected by increasing international integration, notably TPP (VERP 2015). Import of livestock and livestock products, especially dairy products, from countries of comparative advantages (New Zealand, United States) is on rise. From the perspective of consumers and importers, the dairy market becomes more competitive after tariff removals, but it uncertainly could help domestic prices fall. While dairy (processed) products will suffer more from acute competition of imported products, raw milk can take advantage of natural trade barriers (i.e. perishability of fresh milk). Competition pressure mainly comes from powder milk. Short-term impact is not really clear, but to ensure the long run, it is necessary to push sector restructuring to raise quality and competitiveness (dairy zoning, feed crop production, control over imported powder milk). Vietnamese dairy enterprises have to invest into modern and advanced technology and sustain their market shares. Additionally, given imprecise packaging regulations and insufficient quality control as institutional bottlenecks (Pedregal and Luan 2009), it requires transparency in defining fresh milk, publicizing information of milk products to protect benefits consumers and businesses. Moreover, the prices of milk products must be under good control to ensure the access of consumers to products of quality and of reasonable prices and to encourage enterprises to invest in milk production rather than being dependent on imports

4.5. Policy implications

Our analysis highlights the role played by private companies and government intervention in promoting the dairy sector in Ba-Vì, which has emerged recently and undergone a rapid transition. The context of the local dairy industry led to the emergence of three factors that influence transaction costs and hence shape a "mixed" type of governance needed to facilitate transactions along the local dairy chain. The three factors are (i) the structure of the local dairy value chain, which is driven by private industrial-scale processing companies; (ii) specific agricultural characteristics, and (iii) strong backstop of public services. Strong state involvement has taken different forms but is responsible for the initial impulses to the local dairy sector. Entry barriers to production and trade have increased significantly over time. The State uses the barriers by partnering with private firms to facilitate the flows of products and information. Smallholder dairy farmers still have a role in local economy in the context of land constraint and livelihood assurance, but further support is needed to ensure their access to stable markets and help them understand quality and food safety regulations through training, improved support services and protection of intellectual property rights. These measures should be combined with specific regulations aimed at preventing or reducing potential negative effects (exclusion of small producers and processors, environmental degradation, unfair distribution of added value, market competition, etc.). Unilateral decision making by the "captain" of the chain should be replaced by new rules of the game co-constructed with all the actors to ensure a sustainable and inclusive value chain.

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Rapid economic growth, rising demand for animal products, and dynamic public and private investments are favorable conditions for the development of the dairy sector. The dairy farms engaged in the dairy value chain in Ba Vi can be grouped into various types including mixed crop-livestock family farms, specialized family dairy farms, and specialized industrial corporate farms (Khanh 2016; Khanh et al. 2017). This farm diversity can be found in many other milk sheds in Vietnam. From the different development trajectories of these smallholder and industrial farms as well their contribution to the value chain governance, an important research question is to try to assess the sustainability and viability of these farms in the future, with particular attention given to the expected expansion of company farms.

*To contribute to this objective, we present in the following chapter (**Chapter 4**) a perspective scenario planning initiative in collaboration with local stakeholders. This allows us to capture potentials, challenges and opportunities in a landscape characterized by increasing uncertainties concerning the prices of inputs and outputs, climate changes, consumers demand, international trade, and domestic policy agenda. A prospective vision of the dairy sector to 2030 is proposed and discussed. The chapter presents and discusses the outcome of this scenario planning exercises, taking into account different farm sizes and their contribution to sustainable development at local and national levels.*

CHAPTER 4:

SCENARIOS FOR THE DAIRY SECTOR IN VIETNAM TO 2030

© Photo credit: Revalter project (2014-2016)

From left to right, top to down:

(1) Feeding cows in Ba Vi (cut-and-carry dairying system); (2) Dairy barn in industrial large-scale farm; (3) Environmental pollution in a village of North Vietnam; (4) Children in a small village at the outskirt of Hanoi.

Scenarios for the Dairy Sector in Vietnam to 2030

Mai-Huong Nguyen [(a)], Bruno Dorin[(b)], Guillaume Duteurtre[(c)]

(a) *RUDEC/IPSARD, 16 Thuy Khue - Tay Ho - Hanoi - Vietnam. And CIRAD-MOISA, TAC9-15, 73 rue Jean-François Breton, 34398 Montpellier, France. maihuong.nguyen@ipsard.gov.vn*

(b) *CIRAD/CIRED, CHS New Dehli (India); bruno.dorin@cirad.fr*

(c) *CIRAD/Selmet, Montpellier, France; duteurtre@cirad.fr*

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Summary:

After having supporting small-scale dairy production farms, Vietnam has prioritized large-scale and industrial farms in its policy agenda since 2008. The emergence of large-scales and mega-farms questions the future of dairy sector in Vietnam, especially the social, economic and environmental sustainability of dairy farming. The Revalter project depicted 4 plausible scenarios for the dairy sector through participatory scenario planning exercises with sector stakeholders and quantitative simulations. The “Mega-Farms” scenario examines a situation where domestic milk would be exclusively produced by integrated mega-farms of thousands cows. The “Small Farms” scenario is constructed with an exclusive contribution of professional family dairy farms organized in cooperatives and generating a lot of rural jobs in different regions. The “Dual System” scenario is discussed to accommodate different farm models. Finally, the “Devolution Perspective” scenario anticipates a situation where low international prices, free trade agreements and low economic growth would result in the disappearing of domestic milk production. In the context of a rapid transition of the economy and of the ecosystems, taking under limited land, smallholders and family farms are still the mainstay of the livestock sector and continue to play an important role in social and environmental development. Appropriate policy actions are needed to ensure the coexistence of the different farms in view of balancing the supply and demands as well as adapting to the puzzles of local land, labor and environment.

Keywords: *dairy sector, scenario, development pathway, prospective, Vietnam*

Résumé

Après avoir soutenu des exploitations laitières familiales, le gouvernement vietnamien priorise les fermes industrielles et à grande échelle dans ses politiques depuis 2008. L'émergence des grandes fermes et des méga-fermes interroge l'avenir du secteur laitier au Vietnam, en particulier les trois piliers du développement durable: économique, social et environnemental. Le projet Revalter a décrit 4 scénarios plausibles pour le secteur laitier à travers des exercices prospectifs de construction du scénario avec des acteurs concernés et des simulations quantitatives. Le scénario «Méga-Fermes» examine une situation où le lait domestique serait produit exclusivement par des méga-fermes intégrées, avec des milliers de vaches. Le scénario «Petites Exploitations» est construit avec une contribution exclusive de fermes laitières familiales professionnelles organisées en coopérative et générant beaucoup d'emplois ruraux dans les différentes régions. Le scénario "Système Duel" est discuté pour s'adapter à différents modèles de ferme. Enfin, le scénario «Involution du Secteur laitier» anticipe une situation où les bas prix internationaux, les accords de libre-échange et la faible croissance économique entraîneraient la disparition de la production laitière domestique. Dans le contexte d'une transition rapide de l'économie et des écosystèmes, les exploitations familiales et les petits exploitants continuent des activités d'élevage et jouent un rôle important dans le développement social et environnemental. Des mesures politiques appropriées sont nécessaires pour assurer la coexistence des différentes exploitations en vue d'équilibrer l'offre et la demande et de s'adapter aux contraintes de la terre, du travail et de l'environnement.

Mots-clés: *secteur laitier, scénario, trajectoire de développement, la prospective, Vietnam*

1. Introduction

Vietnam has experienced a rapid growth in dairy sector since the launch of economic reforms, termed *Doi moi,* in 1986. Following major agrarian reforms and innovations (such as the decollectivization of land, new programs of research and extension, and breeding innovations) many farmers engaged in milk production to respond to the emerging demand (Duteurtre et al. 2015). Alike other developing countries that have experienced the Livestock Revolution (Delgado et al. 1999), several factors have boosted the consumption of milk and dairy products in Vietnam, such as the rise of income and purchasing power, population growth, urbanization, and changes in dietary habits (L.T.T.Huong 2016). Those economic and market drivers have favored the development of domestic dairy production and also of importation of dairy products (N.M.Huong et al. 2015). In addition to the efforts to respond to the growing domestic demand, the dairy industry in Vietnam has strived for greater efficiency and sustainability. Growing concerns for sustainability, in particular, have been due to the volality of milk and feed prices, increasing competition from foreign products related to free trade agreements (VERP 2015), land constraints, farm labour productivity and organization (Hostiou et al. 2012) and enviromental externalities (Steinfeld et al. 2006, 2010). In this context, public polices from 2008 have given priorities to the development of large-scale family farms (more than 30 cows) or industrial farms (more than 500 cows), mainly in an attempt to increase the level of milk self-sufficiency and reduce import dependency (DLP 2008). However, milk production has still been dominated by small-scale family farms: in 2013, farms of less than 5 cows contributed for 75% of the local milk output (DLP 2014b). Dairy farms of all types have faced a number of challenges towards sustainable and inclusive development in a context of rapid structural changes, agricultural transformation, and ecosystem transition (Khanh 2016). The main concern is whether the future models for dairy production should be based on family farming or large-scale production (N. M.Huong et al. 2016). In order to contribute to the current debates on what farm models to be promoted and supported, it is crucial to envision the possible future development pathways of the sector.

This paper aims at raising awareness among stakeholders of the dairy sector, especially policy markers, on factors that may shape different development pathways. To reach this objective, we propose to build prospective scenarios for the dairy sector to 2030. First, we present the theoretical background of our approach based on future studies (section 2). Then, we explain the method and materials mobilized in our project (section 3). In the next section, we present an overview of the emerging dairy sector in Vietnam, and

describe the 4 scenarios developed for the dairy sector in Vietnam to 2030 (section 4). Our work envisions possible future pathways that can be considered by policy makers and stakeholders in the present, in order to support policy decisions and private strategies in the future. The last section discusses the policy implications and research perspectives that follow our prospective exercise.

2. Background to the prospective approach

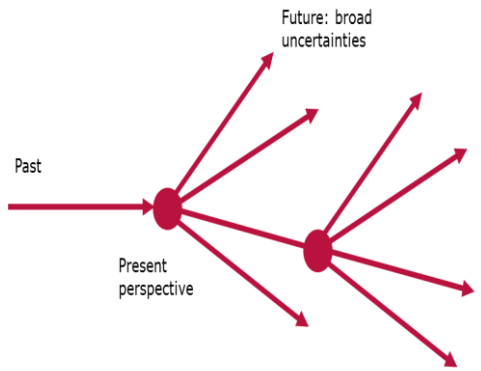
2.1. Theoretical framework for scenario planning

Future studies, referring to both participatory and problem-oriented approach, have emerged in a context of high uncertainties on the dynamics of socio-economic and environmental systems. Growing interest in examining and probing futures in the decisions of institutions and organizations is driven by unpredictable ways that forces are moving (Fuller 2015; Spers et al. 2013). Futures-thinking exercises, *prospective* [61] *approach,* or strategic scenario building do not claim to eliminate uncertainty with predictions; instead, they seek to anticipate uncertainty as much as possible and to enable people to make decisions in view of desired futures.

Scenarios analysis is opted for researches on future agriculture and food system (Oborn et al. 2013; Tansey 2013; Paillard et al. 2014; Bodirsky et al. 2015; OECD 2016). Those works underline that the future of a given community or system is the result of past actions, and the justification for present actions. In other words, it is not only the past that explains the future, but also the image of the future which leaves an imprint on the present (Fuller 2015). A scenario is simply a mean to represent a future reality in order to shed light on current action in view of possible and desirable futures. Rather than attempting to forecast a single future, agri-food scenarios represent multiple plausible directions that future changes may take and what these directions would mean for food security, environment or rural livelihoods (Figure 4.1; Figure 4.2). Swart et al. (2004) define integrated scenarios as coherent and plausible stories, told in words and/or numbers, about the possible co-evolutionary pathways of combined human and environmental systems. Scenarios "enhance our understanding of how systems work, behave and evolve and interact" (Nakicenovic et al. 2000), and so can help the assessment of future developments under conditions of uncertainty, human choice and complexity (Swart et al. 2004; Bodirsky et al. 2015) as well as under alternative policy directions.

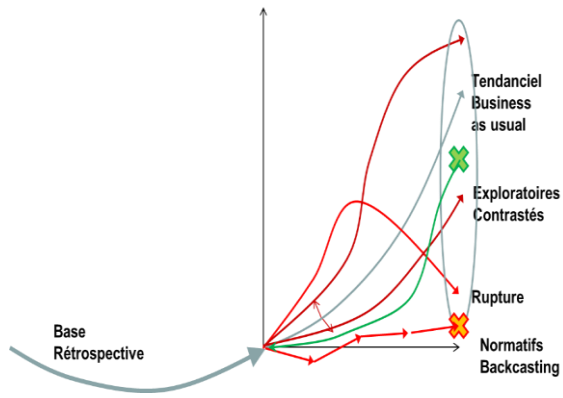
[61] The term *prospective* is preferred in the French literature, but the literature in English rather refers to "foresight" or "future studies" (Berger 1957; Godet (2006))

Figure 4.1: There are alternative (possible) futures….



Source: (Fuller 2015)

Figure 4.2: Different types of scenarios to mark the space of possible future



Source: (Trevor 2015)

Scenarios are neither predictions nor forecasts due to the systems' uncertainties. In addition, scenarios encompass problem boundaries: they propose a characterization of current conditions and processes driving changes, an identification of critical uncertainties and assumptions on how problems are resolved, and a set of images of the possible or plausible future. Scenarios are a characterized *descriptive* (i.e. scenarios describing possible developments starting from what we know about current conditions and trends) or *normative* (i.e scenarios constructed to lead to a future that is afforded a specific subjective value by the scenario authors) (Swart et al. 2004). Ducot and Lubben (1980) put that scenarios can be *exploratory* (i.e projecting the developments forward) or *anticipatory* (i.e. unfolding a neutral future). They also refer to the *'trend scenario'* (i.e. scenarios built upon existing courses of actions) and "*peripheral scenario*" (i.e. scenarios constructed by an unprovable course of events). The art of scenario analysis can lay on the combination of writing long-term narratives (*qualitative* analysis) and assessing a set of indicators (*quantitative* analysis). Quantitative analysis, often based on modelling, refers to mathematical simulations that represent key features of human and environment systems, to forecast the transformation of the economy, its pressure on the environment, and the resource constraints. But quantitative forecasting is restricted upon the uncertain state description, poorly understood causal interactions and insignificant non-quantifiable factors (Swart et al. 2004). Accordingly, it is suggested to integrate quantitative analysis with qualitative scenario exploration to be able to capture other factors influencing the future such as system shifts and surprises or non-quantifiable issues such as values, cultural shifts and institutional features. Scenario narratives give voice to the important qualitative factors shaping development, providing a broader perspective than what is possible from mathematical modelling.

Trends, uncertainties and their relations are the key elements to capture for building scenarios. In this attempt, Godet (1993) states that the scenario must comprise a detailed description of a future situation, including the action of the major players and the estimated probability of uncertain events, structured in such a way as to describe in a coherent manner, the transition form the initial situation to a situation. Since the mid-1980s, the approach of scenario workshops has proven its effectiveness in meeting criteria for scenario planning: appropriable, simple and rigorous (Godet 2006), as well as in making research more relevant to policy development and action through stakeholder participation (Swart et al. 2004). Godet (2006) presents a specific 7-step Toolbox for Futures Thinking to be applied in the corporate prospective exercises, including strategic prospective workshops. Nakicenovic et al. (2000) present a workshop-based method for constituting specific food demand scenarios for total and animal-based calories, using population and income projections as inputs. Most authors insist on the importance of the participation of "concerned" stakeholders in such workshops, in order to facilitate the appropriation of the prospective exercice by the community in charge of the governance of the system (Godet 2006). For more "exploratory" approaches devoted to draw innovative and contrasted scenarios, it seems more pertinent to embark "experts" in the workshops (Paillard et al. 2014). In those exploratory foresight exercices, researchers are associated with other experts in order to bring complementary points of views. This theoretical framework shows that scenarios are not intended to strictly describe the future situation, given that future reality will be shaped over time, but rather to describe processes and factors that will lead to this future. Knowing these possible future situations and the systems dynamics prepares decision-makers and stakeholders to set strategies and to cope with the uncertainties of this changing environment, in order to ensure positive results of current policies.

2.2. Scenario planning in the dairy sector

Throughout the world, the agricultural sectors and rural regions have significantly changed over the last decades. Policy makers and private players have been facing high uncertainties related to the current and future transitions. This situation has called for applying tools proposed by future studies to agriculture and rural development planning in various context. This has helped deciders to take into account a wide range of influential factors (Paillard et al. 2014; Bodirsky et al. 2015; OECD 2016).

The use of prospective scenarios for designing specific sectorial policies is relatively new in the Vietnamese context. In particular, most policy documents refer to basic economic

scenarios related to production, demographic or GDP growth rates (DLP 2008; 2014b; World-Bank-MPI, 2016). But prospective approaches in the form of pure storylines, non-quantitative scenarios, have hardly been used. In Vietnam, scenarios planning and foresight analysis have just been applied in a few projects in the field of food, agriculture and environment (ARP-RD[62], EPIC[63]). These exercises opted for developing foresight scenarios instead of working on extensive statistical analyses, because they think most mathematical models do not consider the existence of non-predictable exogenous events that may affect the sectorial transformation. Scenarios exercises are very useful in the national context for organizing scientific insights into integrated framework, gauging emerging risks, and challenging the common perception on policy orientations. In particular, the scenarios planning workshops ease the communication between researchers and non-scientific stakeholders (especially policy makers), and facilitate the engagement of diverse stakeholders in scenario design and refinement.

In many other countries, however, scenario planning exercises have been widely used to analyze changes in the agriculture sector in general and in the dairy sector in particular. These exercises have been applied at different scale (regional, national, and local) and for different sub-sectors (farming systems, dairy industry, etc.). The debates on the future of the dairy farming are based on a trend-setting scenario which integrates the current economic context and enabling environment (for example, a significant break with the end of milk quotas) with other variables describing the dairy sector itself (cow population, farm labor, targeted market, dairy farm size, milk prices, etc.). Guesdon et al. (2016) calibrate 6 scenarios for cattle production in the Europe for 2020. The end of 31 years of quota regime in March 2015 have deeply modified the regional and local vision of the sector development as well as the strategies of the dairy farmers. Development prospects for the European and for each national dairy sector in the coming decades will be mainly driven by the set of institutional and market factors, such as contractual arrangements between industries and producers organizations. At national level, prospective scenarios have been designed for the dairy chain in Netherlands (Demeter et al. 2009), for milk supply chain in Brazil (Spers et al. 2013), or for the French milk sector (FranceAgriMer 2015). At a local scale, the future of the dairy sector in the context of the end of the milk quotas has been discussed in the Normandy region (France) to 2025 (Legrain et al. 2015), and in the Britany region (France) to 2020 (Espinasse et al. 2014).

[62] Scenario planning for rural development in Vietnam to 2020 (SPA-RD) (World Bank 2008)

[63] Scenario planning for the future of Food Security, Environments and Livelihood in the Southeast Asia region (FAO 2014), in the framework of the FAO-EC project "Climate-Smart Agriculture: capturing the synergies between mitigation, adaptation and food security".

With this background, the potential of future studies for discussing potential development pathways of the Vietnamese dairy sector appears clearly. Those works illustrate the richness of integrating descriptive and narrative elements with more quantitative information. Narrative scenario analysis facilitates debates on normative trajectories, while quantitative analysis can contribute to an adequate knowledge base, numeral insights and structural consistency.

3. Method and materials

3.1. Scenario planning exercise applied in the Revalter project

In order to support national sustainable livestock development policies, we apply the method of scenario building to discuss future development pathways for the dairy sector in Vietnam. Our approach aims at answering the questions: *"What challenges lie ahead for the Vietnamese dairy sector? What could happen if the Vietnamese dairy developed under different policy environments? What are the impacts and policy implications of different scenarios of change?"* We build scenarios for the dairy sector as a whole in order to connect different levels of analysis (farms, value chain, and sectoral environment). We formulate various assumptions for each level of analysis that are used to design a limited number of "coherent" scenarios. The approach is based on a sequence of 6 steps or stages (Figure 4.3).

- *Step 1: Definition of the scope and goals of the scenarios.* The team characterizes the scope of the foresight study and the level of decisions to be supported. This requires defining the institutional environment of the dairy sector and the partners to be approached. The key players and stakeholders targeted for scenarios planning include policy makers, industries, milk producers, cooperatives, individual dairy farmers and professional associations. With reference to the FAO Agricultural outlook towards 2030/2050 (FAO 2012) and the UN Sustainable Development Goals (SDGs) to 2030, the temporal horizon up to 2030 is identified to analyze projections for medium-term strategic alternatives.

- *Step 2: Identification of dimensions and indicators of interest.* From the results of the activities conducted under the Revatler project, 3 levels of analysis are taken into consideration as inputs for scenario planning panels: farm dynamics, value-chain mechanisms, and territorial development. The team points out key concerns and uncertainties for each of the 3 levels, define key axes and indicators, and then merge ideas under pertinent dimensions (Table 4.1).

- *Step 3: Conduct scenario building panels at district level.* Identified dimensions and indicators are worked on through a consultation workshop organized with local stakeholders (2nd April 2015 in Ba Vi district) to capture issues at different scale (farm, territory and value chain). The internal scenario panel (research team, 5th October 2015) then conceptualized some global scenarios for the dairy sector in Ba Vi district (Duteurtre and Huong 2015).

- *Step 4: Conduct national scenario building workshops.* In the first national scenario planning workshop (1st April 2016), thematic working groups were facilitated to define hypothesis and sub-scenarios (farm structure, value chain and markets, local environment and social networks). The panel confirmed strong trends, identified important factors, uncertain events and facts that may affect the future, and established cause and effect relations between variables (Duteutre 2016). At this stage, driving themes of scenarios are discussed, with a focus on: *(i)* a most likely sub-scenario that assumes historical forces continue to act as in the past; *(ii)* exploratory scenarios that assume the development of outstanding themes, focus on future environment; and *(iii)* a desired or normative scenario. The identified sub-scenarios, due to their prescriptive character as a function of the values and beliefs of the participants, are then consolidated and compared with scenarios produced by internal and local panel to come up with refined scenarios in the form of "storylines". The 4 draft qualitative scenarios are then shared to the 2nd national workshop (15th August 2016) in an aim to have ideas clarified and analyzed as well as scrutinize some technical parameters.

- *Step 5: Scenario building (qualitative and quantitative).* The scenarios coming out after the national planning workshops encompass mutual learning about the knowledge positions, understanding, and preferences of those involved, hopefully leading to better informed decision-making. The variables and sub-scenarios (thematic) previously defined are arranged into stories of 4 future states: 3 states describe different orientations in the development of local production and 1 state describes a situation with no local production (devolution). The quantitative simulation (Figure 4.4), based on the literature, results of previous surveys and expert consultations on technical parameters (**Error! Reference source not found.**; **Error! Reference source not found.**) is applied to the 3 local production-based states to generate projections to 2030**.** This simulation is based on basic macro-economic data (population, GDP) and on a simple sectorial model considering land, herd, feed consumption, yields, milk production, farms, workers and milk consumption (Figure 4.4). In addition to the FAO projections on national milk production, national statistics are used to estimate some of those indicators.

- *Step 6: Text development and policy insights.* Storylines are written to present the scenarios, each one describing their evolution and explaining the cause and effect relationships between variables. In-depth discussions are hosted for validation and exchanging policy insights and policy options. While scenario analysis cannot provide all answers to the questions and challenges raised by stakeholders about dairy sector development in Vietnam, it is expected that this work allows readers to think about the future, and to link the different scenarios to policy orientations and community development agendas.

Figure 4.3: Scenario planning process for Vietnam dairy sector within the Revalter project

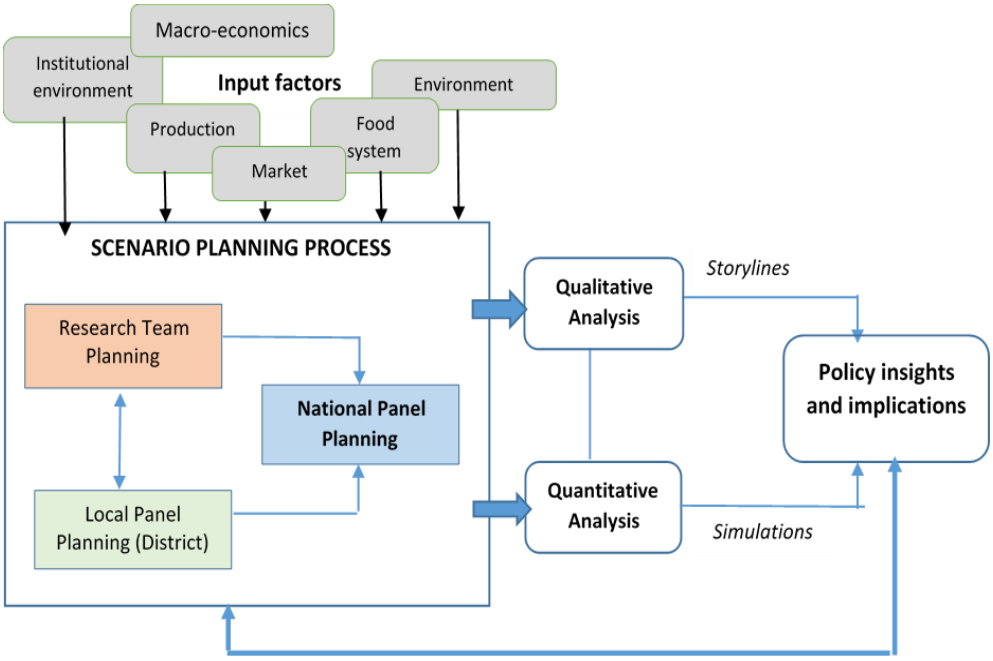


Table 4.1: Dimensions discussed in co-constructing the qualitative scenarios

Dimension	Scope of discussion
Economic environment	Macro-economic issues (growth rate, demographic development, labor issue, land tenure), urbanization, infrastructure (physical); provision of public goods and services; social and economic structure
Agriculture sector	Performance (growth rate by sub-sector, production of crop/livestock land and labor productivity), access to production resources (feed availability, access to land and resources) and production system (farm size, production organization, use of technical resources, collective action, organization of farmers)
Food system	Refers to the food consumption and food habits: evolution of food regime, mode of nutritional transition, food safety, food products in the markets, food policies.
Value chain and supply chain	Organization of the chain, spatial/geographical organization of the chain, competition in the chain, market linkage/market integration, performance of the value chain, milk distribution, international trade, quality control system,

Dimension	Scope of discussion
	preference of clients, milk prices
Production practices	Development trend, Typology of dairy farms, localization of dairy production, availability of feed, collective action, supporting services, farm-gate price, technology and innovation, responses of farms to externalities
Environmental governance	Competition on land use (agricultural land, crops/livestock, imported land), water use, exploitation of natural resources (forest, biodiversity), waste and sewage management, anticipation of climate change, environmental control norms, emissions from livestock, local landscape mosaics (territorial management), norms and polices
Enabling environment	Political and policy change, capacity of involved institution, planning and investment vision, supporting policies, trade policies, trade environment, strategies of central and local government, governance tools (on feed, norm, logistics, social inequality)

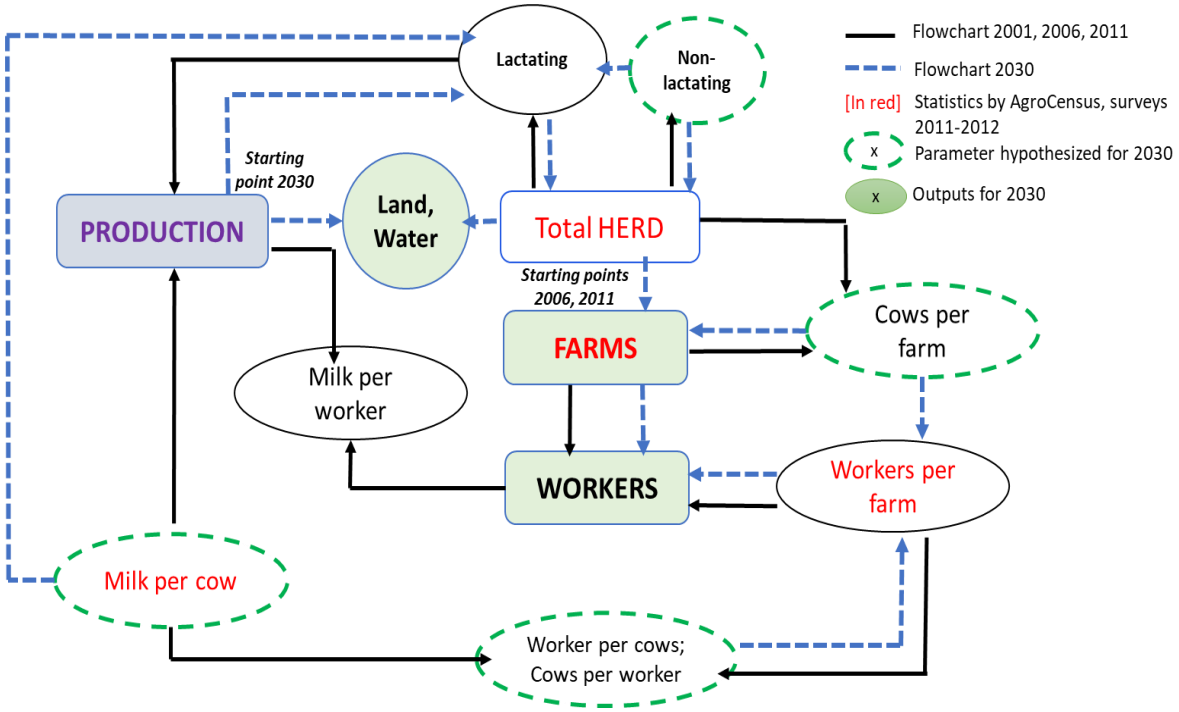


Figure 4.4: Flows of information use for the quantitative simulations in the dairy sector

A schematic representation of the information flow in calculating variables for dairy production. The solid lines show the direction of retrospective information (2001, 2006, 2011), starting from the statistics recorded by the AgroCensus (the total dairy herd and farms by clusters in red letters). The dash lines depict information flows for 2030, starting from the domestic production projected by FAO 2030. The hypothesized parameters for the year 2030 are assumed in the Revalter project, based on to the 2011 level, DLP surveys, and expert opinions. Outputs of the year 2030 (Farms, Workers and Land and Water demand) are indicated in the green shaded box

3.2. Data and materials for qualitative simulation

Our approach use country-based historical data extracted from FAO projection 2030/2050 (FAO 2012) to fit regression of dairy demand for milk in the coming 15 years. Plus, data retrieved from national statistics (VHLSS, Agro Census, livestock survey) are consolidated to build the data set. Besides, the data necessary to construct the scenario

is based on the characterization of the dairy sector in Vietnam (DLP 2014a, 2015b; GSO 2012) and the dairy value chain at local level (Ba Vi milkshed, Hanoi) (Khanh 2016).

Table 4. 2: Composition of data used

Indicators	Source	Time frame
Economic growth	UNStat 2013	1960 – 2013
Population	UNStat 2013	1960 – 2013
Milk demand	Faostat 2014, 2016	1960 – 2013
Productivity of dairy farming	National statistics (DLP), reports	1990 - 2013
Dairy farms by herd size	Agro Census by GSO, MARD reports	2001, 2006, 2011
Technical parameters of dairy performance at farm level	DLP-RUDEC survey 2012 (12 provinces)[64]	2009, 2011
	Report of TH Milk (Revalter, 2015)[65]	2015
	Revalter survey in Ba Vi (160 farms)	2013-2014

In our scenarios, we kept the same macro-economic setting (economic growth, population, land availability, milk demand, per capita income). But different situations of the Vietnamese dairy sector were captured in the simulations through the heterogeneities of farm types, the size of properties and milk producers' profile. Based on historical statistics and consultations with experts, dairy farms in Vietnam were grouped into 4 clusters: 1-9 cows (Group 1: small farms), 10-99 cows (Group 2: medium farms), 100-499 cows (Group 3: large farms) and above 500 cows (Group 4: mega farms). The first two groups were considered as family farms, while those belonging to the two other groups were considered as company farms.

The quantitative exercise towards 2030 for these farm groups gathered the following variables:

- *Causal variables (scenario parameters):* projected domestic milk production and hypothesized share of milk production by different farm groups. The value of each of those variables is fixed for each scenario. They relate to basic assumptions made for each scenario.

- *Intermediate variables (technico-econonmic parameters):* milk per cow, cows per farm, workers per farm, workers per cow; forage and concentrate needs in the ration per cow, water requirement (Figure 4.10 in *Appendix*). Their values are constant for each farm protoype. They refer to technical, economic and environmental parameters.

- *Resulting variables:* total number of cows, total number of farms, total workers in the dairy, milk per worker, concentrate demand (economic and social impacts); domestic land for forage, external land for imported high-yielding forage, water stock

[64] RUDEC and DLP (2012)
[65] Duteurtre et al. (2015)

(environmental impacts). Those variables are calculated for each scenario by our simulation model. They allow to describe the impact of each scenario on the dairy system.

Table 4.3: Hypothesized scenario and technical-economic parameters for the scenario planning – year 2030

Parameters	Unit	General	G1	G2	G3	G4
			[1-9]	[10-99]	[100-499]	[500+]
Scenario parameters (causal variables)						
(S1) Domestic production by farm type	%		0%	0%	0%	100%
(S2) Domestic production by farm type	%		100%	0%	0%	0%
(S3a) Domestic production by farm type	%		50%	20%	10%	20%
(S3b) Domestic production by farm type	%		5%	30%	15%	50%
Technico-ecnomic parameters (intermediate variables)						
(a) Milk production parameters						
Total adult cows	Cows		5	55	300	1500
Lactating cows per farm	Cows		3	33	195	975
Non-lactating cows per farm	% adults cows		45%	40%	35%	35%
Average total milk productivity per year	kg milk/ cow/year	5700 - 6000	5700 - 6000	5700 - 6000	5700 - 6000	5700 - 6000
(b) Employment parameters						
Cows per worker	cows		2.5	9	11	20
Workers per farm	workers		2.4	6	28	80
(c) Feed requirement parameters						
Fodder requirement (fresh matter)	kg/cow/day	45.8	45.8	45.8	45.8	45.8
Fodder yield, dried alfalfa hay (North America, on average) (DM)	Ton per ha	10				
Concentrate requirement per liter of milk	kg	0.4	0.4	0.4	0.4	0.4
Concentrate requirement per cow	Kg/cow/day	7-8	7-8	7-8	7-8	7-8
Water requirement (cows drinking only)	liter/cow/day	100-120	100-120	100-120	100-120	100-120

The share of domestic production by farm types are hypothesized on the basis of anticipation by local stakeholders consulted and government strategy visions. The two first hypothesis characterize two extremely contrasted states: 100% produced by the mega-farms **(S1)** versus 100% milk produced by small farms **(S2).** S3 accommodate the diversified farm categories. **S3a** depicts the minor contribution of small farms, higher contribution of medium farms and largest role played by the mega farms. **S3b** keeps the same weight on production by farm groups in 2015.
The variables and parameters are hypothesized based on Agro Census 2011, the periodical survey carried out RUDEC (2012) in 12 provinces under surveillance system of DLP/MARD[66] and the consultation with the sector experts. The fodder imported is assumed by the demand for dried *alfalfa hay,* which the very rich supplement source for the dairy production[67]. We assume in the simulation exercise that alfalfa hay accounts for 20% of the fodder meals and the average alfalfa in the America reaching 8-8.5 tons dried per hectare in 2011-2013 and around 10 tons dried per hectare in 2030.

[66] The survey conducted every two years

[67] It is said by the local experts that 15-20% of the alfalfa hay in the fodder ingredient (daily feeding) help to raise the milk yield (of good quality) to 15-20%. According to the recent statistics (DLP 2014a), big milk companies in Vietnam (TH True Milk, Vinamilk, Moc Chau) imported 850,000 tons alfalfa hay (costing US$ 5 million) from the United States, Argentina, Canada, etc.) at relatively high prices (US$450-500 USD per ton).

4. Scenarios for the dairy sector in Vietnam: presentation and outcome analysis

4.1. The dairy sector in Vietnam: an emerging sector

Vietnam has no tradition in production or consumption of dairy products (Phong 2009). Milk production was introduced in the early 20th century by foreigners, though it did not develop significantly until next century (Duteurtre et al. 2015). In the 1970s, during the collectivization period, a limited number of large state-owned dairy farms were set up, mainly in the North and Central regions. After the economic reforms (*Doi moi)* that started in 1986, those State farms were partly and progressively privatized. Some smallholder private farms emerged together with public and private processors operating on both the informal and formal sectors (Duteurtre et al. 2015). But it is only in the 2000s that milk production started to increase spectacularly (Figure 4.5).

Besides the economic growth, increasing population[68] and emerging milk companies, the impressive development of dairy production in Vietnam has been driven by the changing dietary habits that gave a growing importance to milk and milk products in the food diet, especially for children (Loan et al. 2004). In addition, a major Dairy Development program[69] was launched in 2001, providing credit and input services to smallholder farmers in peri-urban areas as well as in a limited number of rural areas (Tam 2004; Vo 2011; N. M. Huong et al. 2016). The expansion of smallholder dairying was based on integrated crop-livestock systems. Despite the hike of milk prices in 2006-2007 and the melamine crisis in 2007-2008 that discouraged dairy farmers, the production continued to rise in the 2008-2009 season and later. Between 2001 and 2014, the dairy herd quintupled from 41,241 to 227,020 cows, mainly on smallholder farms. During the same period, milk production rose from 64,703 to 549,533 tons (DLP 2014). Whereas in 2001, only 21 provinces were concerned by milk production, 44 provinces engaged in the sector in 2013. Between 2010 and 2014, per capita milk consumption increased from 15 liters to18 liters (FAOSTAT 2015).

Dairy production in Vietnam in 2015 is reported to have reached 700,000 tons (DLP 2015b), with a concentration of farms in the Southeast region (70% of the domestic production and 51% of total cow herd), followed by the Northern Mountains (9.75% domestic production, 9% of total dairy herd), and the Red River Delta (7% of total

[68] It is expected that by 2035, at least 54% million of Vietnam's 108 million citizens would be urban residents, almost 25 million more than today (World Bank and MPI, 2016). The urbanization rate, now at around 33%, would need to increase of 2% per year to meet this target, matching the pace of the past 20 years.

[69] Decision 167/2001/QD-TTg of the Prime Minister dated on 26th October 2010 on solutions for development of milk production for the period of 2001-2010

production, 10% total dairy herd). Over the past five years, the Central Coast region has emerged as a major dairy production region in Vietnam with an increasing concentration of large farms invested by companies like TH Milk (in Nghe An), an Vinamilk (in Thanh Hoa, Nghe An, etc.) (GSO, 2014) (Figure 4.6). Despite those achievements, Vietnam has not yet reached self-sufficiency in dairy production (Hemme and Otte 2010) and is still one of the 20 countries having the largest importation of milk products (AgroInfo 2014). The local milk production only satisfies 30% of domestic demand (DLP 2014) and dairy industries complement the local supply with imported milk powder and dairy products worth around US$1.1 billion a year[70] (Vietnam Customs 2015). In the longer term, this may have wider implications for the Vietnam dairy sector in terms of restructuring the dairy farming system (herd size, feed production, farm labor and localization of dairy farms).

Figure 4.5: Growth of the dairy sector

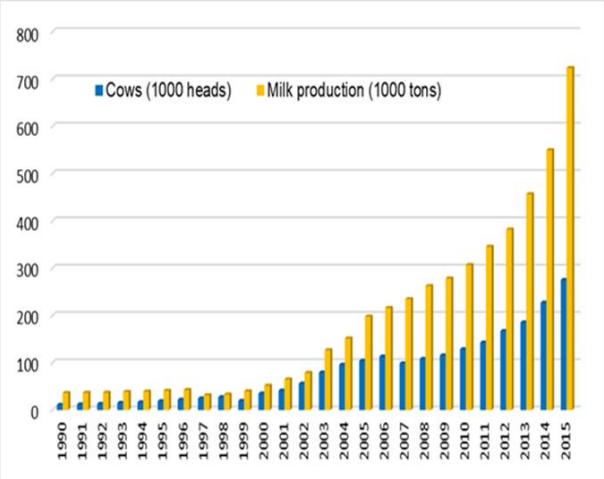
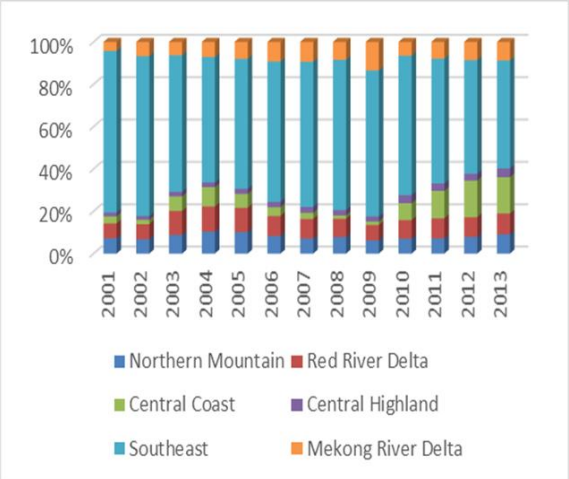


Figure 4.6: Dairy population by region



Data source: DLP (2014a).

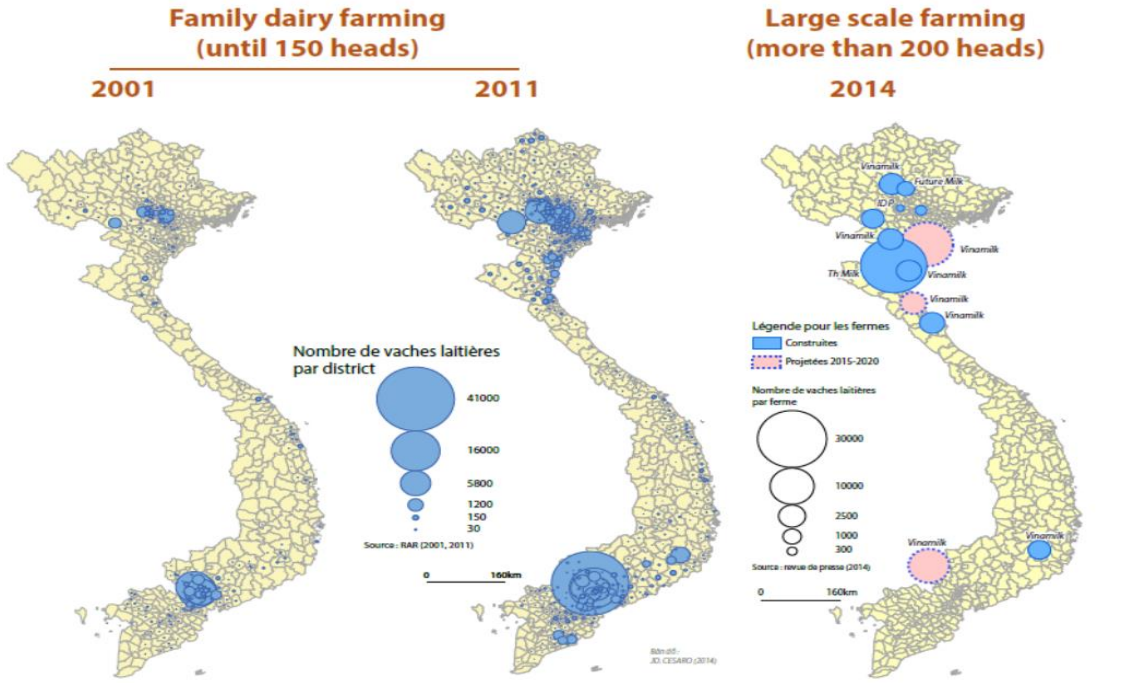
Production scale: increasing of the large-scale farms

Dairy production in Vietnam is scattered with 75% of the dairy cows herd raised by nearly 24,000 smallholder dairy farms having less than 10 cows per farm (DLP 2014a). Those farms show interesting performances due to the use of family labor and to the intensive production of forages, but they face also some constraints related to animal diseases, restricted land access, low level of mechanization, weak professional organization and high collection costs (Khanh et al. 2016).

[70] Key exporters of dairy products to Vietnam include New Zealand: 25%; US:24%; the Netherlands: 7%; Netherland: 5%; and Australia: 4% (GSO 2017)

However, the proportion of large-scale farms has been recently increasing quite rapidly. Due to new private investments, availability of new large-scale technology, higher market demand and industry-oriented public policies, a significant number of large-scale farms have emerged (N.M.Huong et al. 2016) (Figure 4.7). In 2014, there were about 15 mega-farms having from 1,000 to 5,700 cows per farm in Vietnam. In addition, 5 mega farms were under construction. In 2015, the industrial mega-farms[71] contributed to 34% of the cow herd, and family farms represented 66% of the total national dairy herd.

Figure 4.7: Expansion of large-scale and mega-farms in Vietnam



Source: Revalter Project (2013-2016). Cartographic: Jean-Daniel Cesaro (2014)

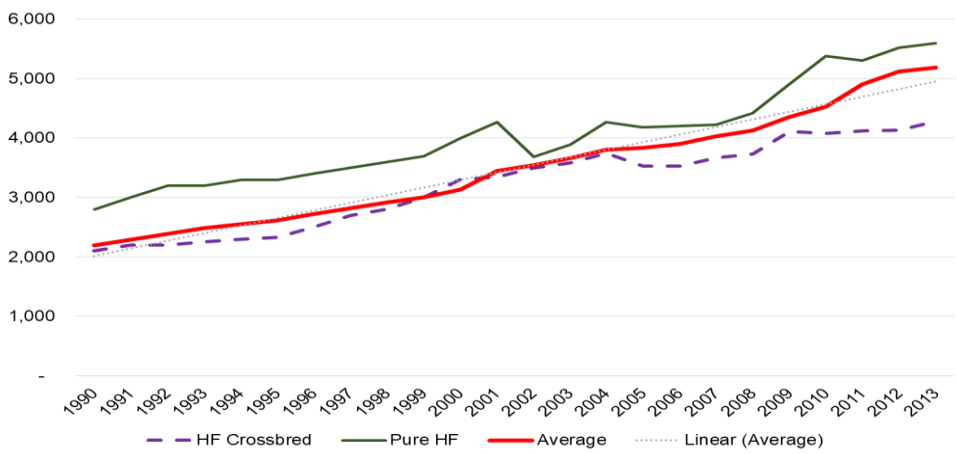
Dynamics of the dairy farming at farm level

Together with the structural change in farm size, both small-scale and large-scale dairy farms have undergone technological transformation by themselves (improved breed, higher quality feeds) to improve productivity and raise income by unit of land, per head of dairy cow or per unit of labor input. The use of artificial insemination (AI), and knowledge of genetic upgrading and crossbreeding has led to increased milk production. Currently,

[71] As for July 2015. TH True Milk has 2 in-house farm clusters in Nghia Dan (Nghe An) with a herd of 37,000 dairy cows (the company is planning to have 203,000 cows in 4 farm clusters by 2020); Vinamilk has 7 large-scale farms in Tuyen Quang, Thanh Hoa, Nghe An, Ha Tinh, Binh Dinh, Lam Dong, Tay Ninh with total of 46,000 dairy cows; Da Lat Milk has 1 farms of 1,000 cows in Don Duong (Lam Dong); Hoang Anh Gia Lai invested in a 6,000-dairy cow farm in Dak Ya district (Gia Lai), supplying to Nutifood about 10,000 ton of raw milk a day; Duc Long Gia Lai announced a scheme to set up a farm of 80,000 dairy cows in Dak Nong province in cooperation with Vinamilk (Synthesized from media and press)

HF crosses dominate in dairy production in Vietnam, mostly F2 and F3 (Cai 2009; Gautier 2008), accounting for 70% of the national dairy herd (DLP 2015a). Efforts in breeding research and development have been improving milk productivity per cow (an increase by 100kg per year) (Figure 4.8). The average annual productivity per lactation increased from 3.3 tons in 2001 to 5.2 tons in 2014, ranking highest level among ASEAN countries (3.2-3.4 tons in Thailand, 3.1 tons in Indonesia, 3.4 tons in China), but still lower than other countries in East Asia (Japan: 9.0 tons for high-yielding cows, 8.1 tons on average[72]; South Korea: 7.8 tons; and Taiwan: 6.7-7.1 tons)[73]. Average productivity of the pure-HF cows is 5.6-6.5 tons a year, while crossbred cows (HF-Zebu) produce 4.3 tons on average (from 3.2 to 5.4 tons).

Figure 4.8: Progress in milk productivity (kg per lactation)



Source: DLP (2007, 2008, 2014a, 2014c)

To the upstream of the dairy system, challenges relate to the shortage of land for feed production. Before 2000, dairy farming was mainly associated to forage production on farm. The recent expansion of industrial farms and intensification of the farming systems have outpaced the domestic forage and fodder supply capacity. Forages cultivated on farm cannot satisfy 100% of the roughage requirements anymore. And an important proportion of farmers now buy fresh or dry forage from surrounding farms or event from abroad (L.T.T.Huong 2016). Concentrates are also an important of the diet used by dairy farmers (Son 2015). Between 2000 and 2013, maize imports rose from 0.2 to 2.6 million tons, and soya cakes from 0.3 to 2.8 million tons (Faostat, 2017). Higher dependence on imported forage and feed ingredients (maize, soya, etc.) puzzles the sustainable development of the dairy sector and reflects the use of “external land” for producing feed

[72] Japan had 923,000 lactating cows in 2013.

[73] Regarding the developed countries, the productivity per lactation, in 2013, is reported to be 21,822p (equivalent to 9.88 tons) in US, or even higher in Canada (USDA)

to be shipped to Vietnam. Indeed, the surge in feed demand (soybean, maize) from Asian countries has been reported to indirectly contribute to deforestation in Brazil or Argentina and to GHG emission through the production of soybean and maize (Steinfeld et al. 2010).

Climate change and environmental issues

Challenges posing the livestock and dairy sector are environmental pollution and significant greenhouse gas emissions (carbon oxide - $C0_2$, methane - CH_4, and nitrous oxide - N_2O) (Steinfeld et al. 2006). In dairy production systems in developing countries, emissions per unit are in the range of 3 and 5 CO_2-eq per kg FPCM at the farm gate (Gerosa and Skoet 2012). Pollution from livestock manure has adverse impact not only on residential landscape but also water source, land and performance of livestock activities (World Bank 2016). A concentration of dairy cow requires a strict package of environmental norms and rules. Large-scale farms have to address two major problems for the locals: water use and waste management. Water in demand for sustaining dairy cow production is critical since overuse of surface water and ground water can lead to water shortage in dry season.[74]

Waste management is also a big question for livestock production, especially large-scale farms. According to DLP (2014), between 2009 and 2011, livestock produced 80 million tons of wastes, of which 36 million tons of liquid waste. Only 40% of solid waste and 60% of liquid waste were treated (Binh et al. 2008). All environmental norms and regulations are not strict enough to detain mega-farms from polluting environment. In many provinces, the locals complaint about stench and pollution of surface and groundwater. These wicked problems raise concern over a relevant production model that have minimized negative impact on the environment.

Institutional and policy environment

The current dairy development in the country is rooted in the National Dairy Development Plan (NDDP) initiated in 2000 and reinforced by Government Decision No.167[75] (2001) supporting dairy development for the 2001-2010 period with a focus on smallholder production. More recent policies and strategies on livestock production (the Strategy for livestock development toward 2020 (2008), and the Restructuring Plan for Livestock

[74] Speech of G. Firhue in Tuyen Quang in 2013

[75] Decision 167/2001/QD-TTg (26/10/2001) of PM applying some measures and incentives to develop dairy cows 2001-2010. Accordingly, the Decision aims at increasing indigenous production in order to increase per capita consumption and to reduce import dependency.

sector (2014)[76]) are clearly oriented towards modern and large-scale farms (DLP, 2014). These policies also include various measures related to the sectorial environment such as longer term for land lease, tax exemption for imported feed ingredients, simplified trading procedures, norms of quality control, etc.). Despite those very ambitious policies supporting dairy production, Vietnam has to permanently adapt rules and laws to the changing situation. For example, quality standards for fresh milk seem to be somehow inefficient to regulate milk marketing. Ambiguity in the use of labels and categories makes consumers unaware of the real content of products made from "fresh milk", which might generate unfair competition between pasteurized milk and reconstituted milk produced domestically (VERP 2015).

Trade liberalization is optimistically claimed to bring benefits to poor and small livestock producers (Nin et al. 2003; Pham et al. 2008); however, the gains from trade liberalization are affected by the allocation of family labor between on-farm and non-farm works rather than profits earned by production and consumption. VERP (2015) proves livestock sector to be negatively affected by ASEAN Economic Community (AEC) and Trans-Pacific Partnership (TPP) which may result to contraction of sectors that Vietnam doesn't get the comparative advantages. Import of the livestock products from countries of comparative advantages (New Zealand, United States) will on a rise. In case of dairy sector, all international trade scenarios proposed by VERP (2015) show that tariff[77] cuts will generate more competition of imported products on the "processed dairy products" segments, whereas fresh raw milk is expected to suffer less because of natural trade barriers (i.e. perishability of fresh milk).

This panorama of the dairy sector allows us to consider the past transformations and the current development issues when building the prospective scenarios. In particular, this literature review on the dairy sector was shared with stakeholder during the different scenario planning workshops.

4.2. Description of 4 scenarios for the dairy sector to 2030

4.2.1. The Revalter foresight initiative

This foresight initiative came out with 4 contrasted scenarios. Those prospective scenarios were based of 4 hypothetical "future states" or "end-line situation" imagined for

[76] MARD's Decision n°984/QD-BNN-CN (2014) approving the "Restructuration of the livestock sector towards improvement of added value and sustainable development"

[77] Under TPP Agreement, tariff under TPP for dairy products: import tariff on dairy products will be completely removed not later than 5 years (currently highest rate is 20%). Import tax on cheese and powder milk will be immediately lifted.

year 2030: *(i)* a situation where milk would be exclusively produced by mega-farms by 2030; *(ii)* a situation where milk would be exclusively produced by family farms, with no mega-farm at all; *(iii)* a situation where there would be a mix of mega-farms and small-scale family farms; and *(iv)* a situation where domestic milk production would enter into heavy crisis, the whole raw materials for the dairy industry being provided by imported milk powder and fat.

On the basis of these "future states", 4 storylines were drafted to "imagine" the development pathways - the scenarios - from 2015 to 2030. Those prospective scenarios included all dimensions proposed in Table 4.1. Some "scenario titles" were proposed to characterize each of those 4 development pathways: (i) the "Mega-farm" scenario (MF); (ii) the "Small farms" scenario (SF), (iii) the "Dual System" scenario (DS) and (iv) the "Dairy Involution Perspective" (DIP). In the "Dual system" scenario, two different sub-scenarios (DSa and DSb) were proposed to simulate different proportions of large, middle and small farms in total domestic production.

We did quantitative simulations to characterize the 3 first scenarios in which domestic dairy farming plays a significant role. In those quantitative simulations, the same milk production objective (700,000 tons) was considered for all scenarios and some basic "landscape indicators" were considered invariant (Table 4.5). For the "Dairy Devolution Perspective" scenario, no quantitative simulation was proposed, and the progressive disappearing of domestic dairying was only qualitatively sketched.

The following sections presents the 4 scenarios developed in storylines and in tables summarizing the qualitative values (Table 4.4) and quantitative simulations (Table 4.5).

4.2.2. The "Mega-Farm scenario (MF)

In this scenario, Vietnamese milk production will be entirely supplied by a small number of very large integrated industrial farms (78 to 82 farms). The country is more and more deeply integrated into global economy with quite a few regional and international FTAs enhancing the contribution of competitive firms of the agricultural sector and agro-businesses. Strong population growth and increased urbanization put pressure on food markets and the distribution sector becomes more and more industrialized and concentrated. Rising per capita incomes generate higher demand for protein-rich and animal produce-based diets, including milk products. To satisfy the increasing domestic demands and to respond to the severe competition from imported livestock products, the Government, in coalition with private firms, only supports large-scale concentrated farms

and industrial 'mega-farm' of thousands cows. In order to set up those farms, local authorities facilitate transfer of land from smallholder farmers to corporate investors. This policy is clearly driven by the focus on large-scale modern dairy technologies and by the model of industrial production where production costs are reduced through concentration and economies of scale. High hygiene standards and food safety guaranties are the major concerns of consumers who do not look for specialty products, but rather for uniform standardized products.

This mass production of cheap milk results in costly direct or indirect environmental impacts due to the very high concentration of liquid wastes and the increasing imports of feed raw materials (maize, soybean, etc.) produced faraway in land-abundant countries and fossil energy intensive systems. Those environmental impacts generate a scarcity in the supply of water and natural resources. Forages are partly produced by contract farming in the regions and provinces where large-scale industrial and mega-farms are installed, and partly by the mega-farms themselves that promote intensive large-scale fields. But a significant share of the feed must be imported. The dairy herd is composed of 180 to 190,000 cows of pure Holstein fed with 3.1 million tons of forage (fresh matter) produced on 15000-16000 ha of land, and 480,000-500,000 tons of industrial compound produced from imported raw materials requiring 39,000 ha of external land. Forage shortage and high productivity explain a highly input-intensive production (especially industrial concentrates, etc.). Labor productivity increases strongly thanks to big investments in high technology, reaching 100,000kg milk per worker and per year. Consequently, employment in the dairy sector falls down to only 6,300 workers, i.e., roughly one-ninth of the population employed in dairy farming in 2011.

The social impacts are very problematic in this scenario, with thousands of agricultural workers being excluded from their land and moving away from agriculture. The redundant farmers have to find new livelihoods in their region (non-farm activities) or outside (migration to the cities, looking for jobs in industrial zones, etc.). The social pressure is heightened by increasing land disputes originating from land transfers from smallholder farmers to corporate investors.

The dairy production is integrated with other upstream and downstream activities along the value chain. Large dairy firms control feed production, genetics, dairy processing and distribution. The value chain is hierarchically developed with high economic concentration. Processing techniques focus on long distance transport of UHT and stable products. Hygiene and standard quality is prioritized by manufacturers since they

integrate production-processing-retail chains. Some systemic risks are reinforced through market concentration, with a few large specialized mega-farm companies potentially exercising important market power, but also facing high market risks in case of market crisis. The private capitalist investments spur the development of dairy sector with continued support from the national Government. Local authorities attract those large firms by favorable taxation.

4.2.3. The "Small-Farms" scenario (SF)

In this scenario, we imagine that milk is exclusively produced by competitive professional family farms. Acknowledging the critical role of family agriculture, especially from a social perspective (livelihood in rural labor and employment in the whole country), the Government supports smallholder dairy farmers through long-term and broad development programs and projects.

Those national policies are adapted to each local situation through district-level development plans that support the emergence of milksheds, in strong partnership with dairy processing industries. Small farmers see in milk production a strategic economic option thanks to contract farming with milk processing industries and government supports (technical assistance, access to credit, etc.). Small farmers are better equipped with production and farm management skills. Small farmers are organized in the cooperatives that assume the role of collecting milk and milk quality control. Each farm aims at reaching forage autonomy, which leads them to recycle local manure for growing local fodder or maize. The manure is also used for developing fish pounds and horticulture. Farmers get economic returns from their agricultural activities, which are complemented by off-farm income of some family members. More actions are done to handle solid and liquid waste by both traditional and advanced waste treatment technology to mitigate impacts on environment and larger landscape. Local environment is green and healthy, and many localities tend to develop their own geographical indication for dairy products. New cheese processors appear in some localities which boosts direct local sales and agro-tourism. Rich consumers focus on high quality products with cultural and environment value.

However, Vietnam remains highly dependent on milk powder imports, and the Government has to maintain trade barriers in order to reduce domestic prices volatility and keep local milk prices attractive for a myriad of small domestic producers. Milk production employs around 60,000 workers in nearly 24,000 small farms. Smallholder farming favors local salaried labor engaging in different stage of milk production (raising,

feeding, collecting, etc.). More than 10,000 jobs are created in different milksheds throughout the country. Farmers seek forage autonomy which makes them less dependent on external feed (80% of forage self-produced, 20% purchased). Complementary agricultural and rural activities allow farmers to reach higher incomes. However, land constraint and lack of mechanization limit the reduction of their production costs. Despite the better of forage autonomy at smaller farms, under the scenario, Vietnam still imports equivalent of "external land" to meet the demand for milk and feed.

4.2.4. The "Dual System" scenario (DS)

Aspirations to become "a nation of prosperity, creativity, equity and democracy by 2035" (World Bank and MPI 2016) as well as the determination to fulfil the UN Sustainable Development Goals (SDGs) urge Vietnam to engage in a rapid structural transformation and institutional incentives towards a modern, green and inclusive economy. Despite the decreasing share of the agricultural sector in both GDP and employment, a dual system of agricultural production develops: small and middle-sized multi-functional farms play an important role in local ecosystems; and intensive large-scale farms are highly integrated within the global supply chains. Dual system exists because smallholder farms have access to land for crops and livestock production, whereas the expansion of mega-farms is limited to regions where the former State-farms had been set-up. In districts where large land areas are available, such as on former state-farms, some private investors set up mega-farms in association with large-scale processing units with high technology and capital. Those industries also collect from smaller farmers, thanks to a very dynamic milk collection system based on contracts with private collectors and cooperative farmers. Those processing industries produce generic products of standard quality to satisfy the increasing domestic demand. Small professional farms are also oriented in providing milk to smaller milk processing units, and providing high value dairy products to niche markets and wealthier consumers. Markets and downstream industries (processors, multinational firms, retailers, and supermarkets), put strong influence on structural changes and food supply. But national and local authorities are engaged in strong policy programs to balance concentration and social redistribution. While mega-farm complexes target distant market with long life products, small farms and cottage industries valorize short circuit of their local specialty products. Technological dichotomy is preserved and family production systems increasingly develop towards what is call "professional" and "commercial farms" models. However, to some extent, under different systems, difficulties in addressing environmental management (manure and affluent treatment, water use, etc.) exist.

Family dairying is sustained as the base of rural livelihood and rural employment (85% of the total dairy workers). Yet, smaller farms have to diversify their activities and change their production practices (sell manure, crop production…) and invest in economies of scale and mechanization. Strongly integration and rapid urbanization, high investment in technological innovations lead to high resource-intensive and land use in dairy production at farm level. New technologies are shared quickly and partly provided to smallholder farming via the integrated supply chain. The small number of farmers are organized in cooperatives to sell milk. Dairy farmers have greater roles in building collective action (quality control, power bargaining). Quality labels, geographic indications and certification trademarks emerge, based on 3rd part certification with independent checking bodies in charge of quality tests to ensure the information transparency and good communication between consumers, farmers and companies.

Government continues its supports to not only mega-farms (via favorable land policies, technology) but also family farming (through access to credit, technical assistance, and infrastructure building). Agro-ecosystems are carefully managed under the governance of local authorities and local communities. Additional campaigns to improve natural resources saving and environment preservation are launched by local NGOs. Efficient rural development institutions address emerging concerns related to low labor productivity, smallholder profitability, underemployment among agricultural workers, food safety, low value addition, price-discounted commodities in the markets, gaps in multimodal farm-to-market connectivity, and limited technological or institutional innovations.

The first sub-scenario (DSa) considers that only 5% of the farms will remain under 10 cows whereas the second one (DSb) imagine a situation where 50% of the farm would be under 10 cows as today's proportion (2015). This second sub-scenario would generate up to 36,000 jobs, three times more than the first sub-scenario. The more involvement of small farms would therefore result in better social impacts.

4.2.5. The "Dairy Involution Perspective" (DIP)

This scenario refers to the progressive disappearing of dairy farming in the country. Due to a sharp decrease in milk price, the local domestic dairy farming fails to compete with products imported from abroad. Preferences of local consumers for foreign brands (trust in quality, etc.) and a number of effective FTAs increase the importation of milk and milk products, especially from countries of surplus production (EU, New Zealand, Australia, etc.). The local industry continues to struggle based on processing reconstituted products

from imported powder milk. But all products are generic products of standard to low organoleptic quality, with cheap vegetal fat replacing butterfat. The Government has no policy action in favor of high quality products neither strict regulation on packaging. Local consumers have benefit from decreasing prices of milk and they are not attracted by high value products because of general economic crisis. The economic environment (low economic growth, low income per capita) does not push up the development of the dairy sector. The local dairy production disappears progressively, with farmers obliged to leave rural areas for urbanized centers. Many concerns related to sustainable development (health, animal welfare, environment, etc.) are not considered by the Government because of very limited public resources.

Table 4.4: Morphological matrix of the qualitative scenarios

	Mega-farms (MS)	**Small farms (SF)**	**Dual system (DS)**	**Dairy involution Perspective (DIP)**
By scale approach of Revalter project				
Farm	100% integrated méga farms	100% professional smallholder farms Efficient farms	Mixed by farms with state interventions; Technology dichotomy will be preserved; Traditional production increasingly advanced towards a more competitive models;	No local dairy farming
Value Chain	Completed integrated value chain; The integrated mega-farm dominates (assuming all stages of VC: production, processing, marketing and distribution); Consolidation of retail sector; Importation of milk and feed	Farmers are linked to cooperatives; Captive governance structure. Processors assume only processing and distribution; Importation of milk and feed;	Integrated chain regulated by big industry; Importation of Milk and feed	100 % milk imported; Local companies reconstitute milk from ingredients imported;
Territory	Mega-farms dominate; Increased environment, health, and safety regulations	Small-medium holdings; Intensified quality inspection by official agencies	Small farms in peri-urban zone; Concentrated large and mega farms in rural zones; Biosafety and quality system are placed	Local dairy production disappear; Other livestock activities develop
By key indicators				
Land	Land pressure for livestock in some zones Increasing land use change (and biodiversity); Potential land disputes;	Farmers are relatively autonomy in forage and other home-grown feed crops	Small farms in peri-urban zone; Concentrated large and mega farms in rural zone;	Farmland are reserved for other economic activities
Markets	Common regulated markets; Wide range of long-life products	Common regulated markets; Dairy processors act as lead firm in the market; Higher bargaining power of the farmers through collective actions.	Common regulated markets; Wider product ranges: generic products and local specialty products	Effective FTAs boost imports of milk products
Labor	Pressure from rural labor exodus on other sectors; Migration increases to fill the labor gaps	Family labor are maximized. Increasing use of hired labor	More balanced; Professional family farms use both family labor and hired labor; Smallholder farms increase their income with more off-farm income	No labor in the sector Farmers have more off-farm incomes
Environmental degradation	High: vast 'lagoon' of excess manure in the production zone; water stresses;	Moderate – Mixed farming (livestock-crop) at small farms help to reduce methane emissions	Moderate - Mixed farming (livestock-crop) at small farms help to reduce methane emissions	Low
Enforcement capacity & territory governance	Weak enforcement, weak territory governance (negative social and environmental impacts in the regions)	Strong – Scattered small farms under better horizontal (farmers-collectors-processors) and vertical (farmers in the cooperative) linkages	Strong enforcement and strong territory, geographical coordination	Weak, low coordination action. Focus on quality control of imported
Agricultural investment	Unbalanced - Private investments	Unbalanced, state support small farmers to access to public goods and services	More balanced, high public and private investment	No investment
Production costs	Lower (incorporation of technology, concentration in production in some regions)	Take advantages of family labor; Energy-saving production practices through mixed livestock-crop system	Extrapolations of current forces; burdens on imported technology, capital and inputs	

Table 4.5: Results simulated for the year 2030, based on the FAO projection

	2011	MF (2030)		SF (2030)		DSa (2030)		DSb (2030)	
		Min	Max	Min	Max	Min	Max	Min	Max
Total milk production (MT)	377,400	700,000		700,000		700,000		700,000	
Dairy farms	26,749	78	82	23,333	24,561	1,900	2,000	12,145	12,785
Dairy Workers	52,768	6,222	6,550	58,333	61,404	11,596	12,206	34,123	35,919
Dairy Herd, total (cows)	137,314	179,487	188,934	212,121	223,285	185,606	195,375	198,796	209,259
Lactating cows	72,090	116,667	122,807	116,667	122,807	116,667	122,807	116,667	122,807
Milk per worker (kg/worker)	7,152	106,875	112,500	11,400	12,000	57,358	60,366	19,488	20,514
Concentrates (1000 MT)		483	524	570	619	499	542	535	580
Forage, fresh matters (1000MT)		3,000	3,158	3,546	3,732	3,103	3,266	3,323	3,498
Water (1000 m^3/year)		6,896	7,862	9,291	9,780	7,131	8,130	7,638	8,707
Required land for forage (ha)		15,002	15,792	17,730	18,663	15,513	16,330	16,616	17,491
External land for high-yield grass (ha)		37,787	39,487	44,657	46,667	39,075	40,833	41,852	43,735
Landscape indicators (2030)		- Population:105.447 (kcap); - Active population in agriculture: 34.122 (kcap) - GDP per capital: 2,714 USD				- Cultivated land: 10.443 million ha; - Cultivated land per worker: 0.31 ha; - Total milk production: **700,000 tons** - per capita milk consumption: 19 kg/year			

The share of domestic production by farm types are hypothesized on the basis of anticipation by local stakeholders consulted and government strategy visions. S1 accommodate the diversified farm categories. **DSa** depicts the minor contribution of small farms, higher contribution of medium farms and largest role played by the mega farms (5%; 30%; 15%; 50%). **DSb** keeps the same weight on production by farm group in 2015 (50%; 20%; 10%; 20%).

5. Discussion and policy implications

5.1. Economic implications

In the MF scenario where the large-scale and mega-farms operate in farmland acquired from either ancient state-owned agro-forestry farms or small farmers, the opportunity costs of converting these crop and forestry land to land for building livestock barns and facilities are still unclear. Even in the case of the TH milk company, the Asia's biggest hi-tech cow farm, the opponents question the land productivity by dairy farming versus the earnings per hectare gained from orange growing in the ancient farmland. Shortage of forage grown in the local requires mega-farms to purchase or import feeds (contracting with maize/sugarcane, etc. out-growers, buy industrial feed, etc.). For small dairy farmers giving up dairy production and those stopping agricultural farming on their farmland, they need help and supports to earn living. In the SF scenario, improved cost-efficiency at farm level challenges farmers. While the chain is better organized and segmented, small farmers have to invest more on facilities while processors invest in novel milk processing. Small farmers need financial incentives to be compensated to extra on-farm costs and risks (in case absence of support from dairy processors). In the DS scenario, economic benefits can be achieved through the diversification of products and income for the smallholders. In the system where small dairy farmers diversify their farming activities, economic benefits can be gained by energy savings (thanks to biogas production), sales of organic by-products, and reducer chemical fertilizers. Economic benefits are also diversified by the breeding and feeding strategy of different actors. With a huge number of small dairy farmers, dairy processors have to modify their payment scheme and put stricter quality control over the products. The economic gains, under the SF and DF scenarios, depends on the technology adoption rates of small farms (influenced by prices, market forces, integration) as well as returns from other activities for better livelihood. Accordingly, extension services, technical assistance, etc. should be placed on policy actions of local authorities.

Regarding the value chain organization, the chain under MF scenario is completely integrated and become longer to circulate diversified products. The Government would pay more attention, under the SF scenario, to rules and regulations over the quality standards and subsidies for biogas. The DS scenario accommodates both long and short circuits. Plus, in all scenarios, Vietnam still much dependent on the imported cows and feed, that put pressures on the trade balance and calls for proper strategic response at

macro level (master plan for production of food and feed crops, trade policy, exchange rate policy, etc.)

5.2. Social implications

Employment perspective in all scenarios impose not only economic but also social burdens on the central and local government. Farmers whose agricultural land is acquired by mega-farms find unemployed in their hometowns and villages. Number of dairy workers downsized by more than three quarters in the MF scenario would result to the increasing migration to cities. Social stresses in cities are in question: provision of public services, underemployment, increasing urban slums, etc. Moreover, the development of large-scale farms and mega-farms (in MF and DS scenarios) requires livestock zones to be well-planed and established upon the proactive intervention of public authorities (i.e. the central and local government have vision and incentive of reserving land for livestock zones). The livestock concentration will be focused on some region whereas the other farms will be excluded out of the pathway. Such a high land concentration is always a complicated and hot issue to be addressed in agriculture and rural development in Vietnam. To localize the mega farms in planned livestock zones of limited land availability, it is likely that mega-farm holders have to negotiate and compensate farmers for land lease/buy. With compensations from mega-farm, farmers either invest in other off-farm activities or work as hired farmers or migrate to the cities. However, social stress would emerge from land disputes in case the authorities reclaim land from farmers to transfer to cooperate investors. Land policies therefore would be always in debates.

5.3. Environmental implications

The trajectory of co-existence of the dairy farms (DS scenario) goes with the vision of the Government for zoning the dairy sector. The livestock zone planned and set up in some provinces such as Lam Dong, Moc Chau, Ha Noi, Da Lat and Vinh Phuc. Mega-farms will be set up and expanded in regions of disadvantaged agronomic conditions but applicable high technology. Smaller farms will be sustained in traditional dairy production zones (Ba Vi, Moc Chau…). An intervention and support of Government are needed to reserve land for gathering scattered livestock holdings. The development of farms requires a better plans and visions for land planning, access to capital and environmental management. For better management of the herd, it is likely to sustain the dairy population, reduced number of dairy farms will be compensated by the increase in the number of cows per farm. It is shared among sector experts in our scenario planning seminars the supports rendered to farms of 15 cows or more. Stronger environmental regulations are issued to

request sector stakeholders to respect. It is likely that huge investments by mega-farms in certain zones allow them to handle better environmental issues. However, the high animal intensity in mega-farms in certain zones, under the MF and DS scenarios, put pressure on environment and landscape of the territory. Pollution will be obvious. Despite the increasing adoption of treatment technologies, difficulties still remains, especially regarding the methods for treatment methane. Additionally, in all scenarios, access to resources (land, water) is unequally distributed across regions and affected by climate change impact[78]. The external land for producing imported milk, feed and feed ingredients are placing higher pressure on landscape in other regions (Steinfeld et al. 2006, 2010). The large concentrations of animals and animal wastes close to the residential areas of dense human population cause considerable pollution impacts Government policies are recommended to regulate intensive livestock operations and support environmentally and economically sustainable approaches for waste treatment. Effective energy and novel cow diets are expected to give no additional nutrient losses and GHG emissions.

The increasing demand for feed for intensive and concentrated livestock production in Asia cause indirect adverse impact in land-abundant countries where feed crops are produced (Steinfeld et al. 2006, 2010). Every year, Vietnam has to import a large quantities of animal fodders and material, recording 3.4 billion USD in 2015 (GSO 2017), focusing on soybean, maize, rich-nutrition grass and fodder, etc. (Vietnam Customs 2016) from North America, Brazil, Argentina, etc. Our personal interview with technical director of Future Milk[79] (in 2014) put that maize meal accounts for 30% of the fodder ration. Studies on the smallholder dairy production in the South Vietnam show that daily feed intake, upon different basal diets, for one cow include 6-8kg brewery waste, 5kg cassava meal (Vu and Tri 2008), 1 kg maize meal (Tien et al 2002). However, absence of official and reliable allocation of imported soybean and maize for feeding cows (as fodder or in concentrate) prevented us from taking account external land for soybean production far away. The weight of soybean and maize imported in the feed industry will multiply the imported land as well as subsequent indirect environmental impacts. The expansion of soybean productions to the forests in the Amazon and other regions strongly associates with the GHG emissions: deforestation in Brazil and Argentina releases 37,000 kg CO_2-_eq and 17,000 kg CO_2_eq per hectare, respectively; while clearing of shrub land in Argentina release 2,200 kg CO_2_eq per ha (FAO 2010).

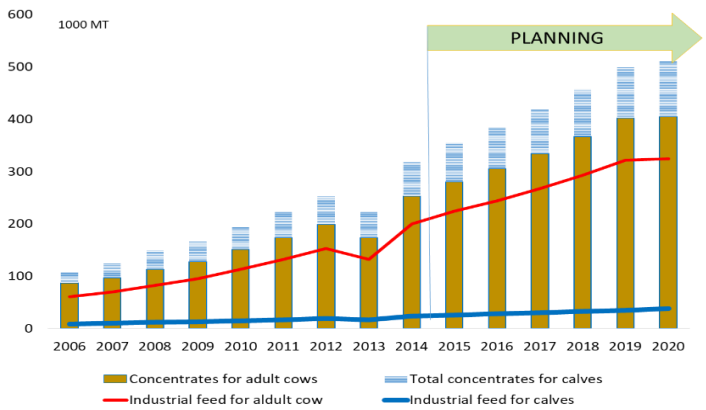
[78] As IPCC scenarios, Vietnam is ranked as one of the five countries most affected by the climate change (ADB 2009)

[79] Future Milk in Tuyen Quang has 1000 cows in 2014.

5.4. FAO projection and Government vision for the dairy production in the future

According to the recent official statistics, the dairy production in Vietnam has reached the FAO projection. In 2015, the herd is recorded about 200,000 cows with the total production of 700,000 tons (DLP 2015b), the production level projected by FAO for Vietnam in 2030 (FAO 2012). The Government set targets 500,000 cows and 1.1 million tons milk by 2020 (Livestock Development Strategy 2008) and the Vietnam Livestock Association has projected 700,000 cows and 2 million tons milk by 2030 (Vang 2014). If total demand for milk projected for Vietnam in 2030 is simply unchanged (2.1 million tons), the Government's planned domestic production could totally satisfy the domestic demand. Nevertheless, the intensive and high energy-cost farming to cover 100% domestic demand would be impossible to happen in a country of land shortage as Vietnam. Two critical questions have been strongly debated among policy makers and other sector stakeholders: Where to install the large and mega farms? How to recuperate land? The Government envisions domestic production meeting 40-50% of the domestic milk demand and endeavors for "*gain more from less*" [80] protocol in transforming agriculture (World Bank 2016). We replicated the simulations with the planned domestic production (1 million and 2 million tons) and see multiplied environmental burdens, especially demand for land growing forage and feed crops (see Figure 4.11, Figure 4.12 in *Appendix).* The strong home market, in the land-constrained landscape, favors the expansion of concentrated mega-farms and trendy overseas investments by big dairy companies (Vinamilk and TH milk). Moreover, our results simulated for concentrates demand under different scenarios converge with the outlook of feed industry in the Government planning (600-700 MT concentrates required for dairy cattle by 2020) (DLP 2014b) (Figure 4.9)

Figure 4.9: Supply of concentrates to dairy production (2006-2020)



Source: Livestock Development Strategy to 2020 (DLP 2008); Plan for Restructuring Livestock Sector (DLP 2014)

[80] It means: generating more economic value – farmer and consumer welfare – using less natural and human capital, and less harmful intermediate inputs. The growth is expected to rely primarily on increased efficiency, innovation, diversification, and value-addition.

The optimal dairy farm size in view of the sustainable development of dairy sector is a puzzle for policy makers in Vietnam. Despite that the commercial farms of modern technology, intensive and semi-intensive production is underlined in the Livestock Development Strategy (MARD, 2008) and Restructuring Plan of livestock sector (MARD, 2014), family dairying still occupies a crucial role in livelihood generation and job creation in the rural Vietnam. Costales et al. (2007) put that smallholder farmers could be highly productivity, and in fact are often more productive than large-size farms. The issue of economies of scale however does not primarily emerge in production. The issue arises mostly in processing, marketing, and distribution. When several standards have to be adopted at the farm level, the necessary changes in production and post-production activities required for a modern agri-food system are more difficult to implement and monitor when a large number of farmers are involved. The complication arises from the coordination of large number of farms. Accordingly, farmer organizations (groups, cooperatives, associations, etc.) could contribute to reduce the coordination problems faced by enterprises in dealing with farmers. Contracts between farmers and agribusinesses, and vertical integration are alternative options. Moreover, taking into the critical context of contracted agricultural land and rural labor pressure, family farms are undeniable a plausible trajectory that Vietnamese dairy sector should continue to step in.

It is therefore recommended to build consistent policies for the sector and for different farm types in view of a sustainable and inclusive livestock and dairy sector: low-energy cost, products of quality, promotion of grassland to take advantages of local conditions, promotion of local know-how to valorize and upgrade local value chain, encouraging the connectivity of livestock (dairy) chains and reducing production and administrative costs. The policy agenda should be based on: general policies for livestock sector, policies for development of industrial livestock and high-tech breeding, and specific policies for household farms. The zoning master plans (livestock facilities, feed crops, etc.) are needed and tailored to the regions.

6. Conclusion

For the dairy sector in Vietnam, the main long-term challenge is to increase its production to meet the growing domestic demand while promoting sustainable development in rural areas. This paper aims to help decision makers to anticipate possible development pathways and to be better prepared for future decisions. The participatory scenario

planning method allows to exploring the prospective scenarios of the dairy sector in particular and of the agricultural sector in general. Some uncertainties regarding certain variables remain; they are related in particular to the milk industry since there are very little reliable data in statistical terms. This is why the qualitative evaluation and the perception of a panel of experts can be more appropriate that a complex mathematical model. The use of stakeholders' workshops enabled us to develop 4 prospective scenarios: Mega-farms, Family-farms, Dual System and Dairy Involution Perspective. They refer to various proportion of different types of farms in the domestic production. All those 4 scenarios cannot be considered likely to occur, but comparing those scenarios brings us to raise issues and questions that the dairy sector may address in the future: economic benefits (through employment, land productivity, labor productivity), social benefits (interaction between value chain actors, effective governance and institutions) and environmental concerns (indirect impact through land availability and land imported, territory management). The 4 scenarios characterize the dairy sector in a rather contrasted manner through farm sizes and production boundaries. Although these scenarios are separately discussed, the implications for scenarios are not necessary exclusively alternatives, but may be considered simultaneously, or synthetically. The 4 scenarios also shows that for sustainable development of the dairy sector, it is important to consider questions of rural labor and imported feed burdens as well as the relationships between different stakeholders, especially the downstream actors. Further in-depth exercises capturing market forces (international and domestic prices), farming practices (ration and technology by farm types) and direct environmental costs (LCA of different systems) are needed to quantify the consequences of scenarios.

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Appendix:

Figure 4.10: Bilan of ration parameters for dairy cow

	Unit	Min	Max	Average	Notes
For a day					
Dry Matter Intake (DMI) (% of body weight)	%	2.90	3.20		for cow producing 20-25 liter milk/day
Total DMI	kg/cow/day	14.50	16.00	15.25	
Forage, all - Dry matter (DM)	kg/cow/day	8.70	9.60	9.15	DM forage = 60% total DMI
Forage, all - Fresh matter (FM)	kg/cow/day	43.50	48.00	45.75	% DM forage =20%
Concentrates - Dry matter (DM)	kg/cow/day	5.80	6.40	6.10	DM concentrate = 40% total DMI
Concentrates - Fresh matter (FM)	kg/cow/day	6.67	7.36	7.01	% DM concentrate = 87%
Alfalfa, hay - Dry matter (FM)	kg/cow/day	1.74	1.92	1.83	DM Alfalfa hay = 20% DM forage (all)
Alfalfa, hay - Fresh matter (FM)	kg/cow/day	2.02	2.23	2.13	% DM dried forage (hay) = 85-88%
For a year					
Forage, all - Dry matter (DM)	kg/cow/year	3,176	3,504	3,340	
Forage, all - Fresh matter (FM)	kg/cow/year	15,878	17,520	16,699	% DM forage =20%
Concentrates - Dry matter (DM)	kg/cow/year	2,117	2,336	2,227	
Concentrates - Fresh matter (FM)	kg/cow/year	2,433	2,685	2,559	% DM concentrate = 87%
Water requirement					
For maintenance	liter/cow/day	40	60	50	
For producing milk	liter/kg milk	2.5	3.5	3	

The parameters are consolidated from different manuals and guidelines for dairy farming, including the “Nutrition and Feeding Management in Dairy Cattle” – a practical manual for small scale dairy farmers in Vietnam (2009), published under the project Vietnam-Belgium Dairy projects. All the indicators are computed based on the dairy cow, at milking phase, producing 20-25 liters milk per day (the average milk yield per cow per day on average across the dairy zones in Vietnam). Alfalfa hay is assumed to account for 20% of the total forage diet.

Figure 4.11: Results simulated for the year 2030, based on the Government plan (1,000,000 tons fresh milk by 2020)

		MF		FS		DSa		DSb	
	2011	Min	Max	Min	Max	Min	Max	Min	Max
Total production (tons)	377,400	1,000,000		1,000,000		1,000,000		1,000,000	
Dairy farms	26,749	111	117	33,333	35,088	2,715	2,858	17,351	18,264
Workers	52,768	8,889	9,357	83,333	87,719	16,566	17,438	48,747	51,313
Herd, total (cows)	137,314	256,410	269,906	303,030	318,979	265,152	279,107	283,994	298,941
Lactating cows	72,090	166,667	175,439	166,667	175,439	166,667	175,439	166,667	175,439
Milk per worker	7,152	112,500	106,875	11,400	12,000	57,358	60,366	19,488	20,514
Concentrates (1,000 MT)		690	749	815	885	713	774	764	829
Forage (1000 MT)		4,286	4,512	5,066	5,332	4,432	4,666	4,748	4,997
Water (1000 m3/year)		9,852	11,231	13,273	13,971	10,187	11,614	10,911	12,439
Required land for forage (ha)		21,432	22,560	25,329	26,662	22,163	23,329	23,783	24,987
External land for high-yield land (ha)		53,981	56,410	63,667	66,667	55,821	58,333	59,788	62,479
Landscape indicators (2030)		- Population:105.447 (kcap); - Active population in agriculture: 34.122 (kcap) - GDP per capital: 2,714 USD				- Cultivated land: 10.443 million ha; - Cultivated land per worker: 0.31 ha; - Total milk production: **1,000,000 tons** - per capita milk consumption: 19 kg/year			

Figure 4.12: Results simulated for the year 2030, based on the Government plan (2,000,000 tons fresh milk by 2020)

		MF		FS		DS (S3a)		DS (S3b)	
	2011	Min	Max	Min	Max	Min	Max	Min	Max
Total production (tons)	377,400	2,000,000		2,000,000		2,000,000		2,000,000	
Dairy farms	26,749	222	234	66,666	70,176	5,429	5,715	34,701	36,527
Workers	52,768	17,718	18,713	166,667	175,439	33,131	34,875	94,495	102,626
Herd, total	137,314	512,821	539,811	606,060	637,958	530,304	558,214	567,988	597,882
Lactating cows	72,090	333,334	359,877	333,334	350,878	333,334	350,878	333,334	350,878
Milk per worker	7,152	112,500	106,875	11,400	12,000	57,358	60,366	19,488	20,514
Concentrates (1,000 MT)		1,380	1,498	1,630	1,770	1,426	1,548	1,528	1,659
Forage (1000 MT)		8,573	9,024	10,132	10,665	8,865	9,332	9,595	9,995
Water (1000 m3/year)		19,703	22,462	26,545	27,943	20,375	23,227	21,823	24,878
Required land for forage (ha)		42,864	45,120	50,658	53,324	44,326	46,658	47,475	49,974
External land for high-yield land (ha)		107,962	112,820	127,592	133,333	111,643	116,667	119,576	124,958
Landscape indicators (2030)		- Population:105.447 (kcap); - Active population in agriculture: 34.122 (kcap) - GDP per capital: 2,714 USD				- Cultivated land: 10.443 million ha; - Cultivated land per worker: 0.31 ha; - Total milk production: **2,000,000 tons** - per capita milk consumption: 19 kg/year			

CHAPTER 5

GENERAL CONCLUSION

1. Research background, objective and methodology

1.1. Vietnamese agriculture and Livestock Revolution at a crossroads

Since the mid-1980, Vietnam has experienced a fundamental transformation of its socio-economic structure. From a poor country, Vietnam has emerged within few decades, as a middle-income nation. The promulgation of new policies fostered Vietnam global economic integration, and scientific and technological advances brought out significant changes for the Vietnamese agricultural production, ranging from actors involved to products and technologies. As a result, demand for land, water, energy and food has increased, putting more pressure on natural resources and ecosystems, and increasing competition between different users (industries, services and cities). In the 10-15 coming years, demographic, economic, and social factors will further alter the context in which the agricultural sector has to compete (World Bank 2016). Vietnam will experience rapid rural and urban population growth, changing per capita income, further urbanization (up to some 50% by 2025) and a large expansion in its middle class whose demands are towards more energy-, land- and GHG emission-intensives food. These drivers accelerate the so-called "Livestock Revolution" (Delgado et al. 1999) in the country. Within the livestock sector, Vietnam has developed an impressive dairy industry, including both large- and small-scale producers, which has made great contribution to Vietnam's economic and social development. These recent agriculture and livestock policies have prioritized the promotion of intensification and industrialization of the livestock sector, through development of large farms, threatening the development of smallholder livestock farms as well as the livelihood of millions of rural people. Plus, livestock is predicted to be greatly affected, not only by competition for resources (land, water) with other sectors (industries, services, cities), but also by animal diseases related to climate change. The biggest challenge facing the livestock sector is growing dependence on the imported feed and feed ingredient (fodder, raw cereal, and soybean cake).

1.2. Research objective and methodology

This thesis aims at exploring the dynamics of the livestock sector, with the dairy sector as a case study, in the structural transformation context of Vietnam. Throughout the world, the agriculture sector has entered a modernization and industrialization process. The livestock sector, in particular, boosted by the Livestock Revolution, has shown a trend toward large-scale farms (Delgado et al. 1999; Delgado et al. 2008; de Haan, et al 2010).

However, a wide diversity of farms of different types remains involved in livestock production because of the limited natural endowments (especially land restrictions), local socio-economic dynamics (economic growth, population, employment, urbanization, rural population exodus to cities, etc.) and other environmental constraints (climate, biodiversity, water resources, etc.),. In Vietnam the role of industrial and commercial farms is underlined to push up economic development, to catch up with the regional forerunners and to adapt to the increasing international integration. However, in a country of limited land but labor abundance, the smallholder livestock farms are still the mainstay of rural livelihood. So, what is the future pathways that the Vietnamese livestock sector has to follow in order to manage this farm diversity? Insights from the dairy sector enable us to draw up some implications for general development of livestock sector.

The analysis from different angles (political economy, value chain governance, prospective scenario planning) allows us to contribute to the ongoing policy debates on restructuring agriculture, including livestock, in Vietnam. The dynamics of the livestock sector in relation to the structural transformation spurs the concerns over the governance and institutional arrangements of the sector. Those sector and territorial dynamics inspire anticipation about the possible development pathways of the sector, taking into account different local constraints and sustainable development goals. The vision on a suitable and relevant livestock form will be shared among involved stakeholders.

2. Summary of the main findings and discussion

This thesis is built on a paper-format structure incorporating 5 chapters. The following Table 5.1 summarizes the main points of the 3 paper chapters (Chapter 2, 3, 4) in line with the research questions posed in the General Introduction (Chapter 1)

Table 5.1: Summary of research questions and main findings in the Chapter 2, 3 and 4

Research Questions	Main points
Structural transformation, agriculture and employment	**Chapter 2**
How far Vietnam follows the canonical model of structural transformation?	The comprehensive political economic reforms of 1986 backstopped by agrarian reforms has transformed Vietnam from a centrally-planned economy to a 'socialist-oriented market economy'. By adopting the economic-political approach to examining 5 periods since *Doi Moi* (1986), it is seen that the Lewis development pathway is contrary to the ongoing dynamics of the country: perceptible decline in share of agriculture in GDP, continued predominance of rural population, farmers on increase (in absolute term) but getting poorer compared to other workers in the economy. According to the model of Dorin et al. (2013), Vietnam has embarked on the "Lewis Trap" as its regional neighbors (China, Thailand, India, etc.).
How its agrarian changes diverge from neighboring Asian countries?	Like other Asian land-constrained country, Vietnamese agriculture is characterized by small and fragmented farms (0.8 ha per farm, 4.7 plots per farm, around 0.34 ha of arable land per member of its agriculturally active population). The agrarian changes in Vietnam have been underpinned by the family farms and significantly associated to the changes in land policies. Decollectivation of agricultural land and productive assets, recognition of household as independent economic unit and introduction of a number of incentives encouraged the agricultural production. Vietnam has emerged as one of the world leading exporter of rice, pepper, coffee, cashew nut, etc. The recent agricultural transformation is seen with the changing composition of agricultural sector, growing number of large and commercial farms, new organization of the value chain, etc. The current dynamics have not been entirely inclusive from the angle of different farming structures nor sustainable from the perspective of environmental costs.
What are the place and dynamics of the livestock sector in these structural changes and development discourse?	Vietnam is in good place in the Livestock Revolution. The analysis of the livestock sector and a case-study of regional development (Ba Vi district) show that that livestock has contributed more and more to the agricultural GDP as well as to the dynamics of territory development (i.e. province/district landscape). The livestock production is also featured by smallholder farming. There is a recent trend on the expansion, intensification and industrialization of livestock production in an aim to catch up with the demand-driven 'livestock revolution". In the livestock sector, e.g. in dairy, a continued predominance of small farms is observed, with the emergence of medium-, large-size, or even mega-operations. In addition to the social stress posed by large-scale farms (in terms of land, labor, etc.), threats posed by high human and livestock densities may lead to environmental degradation and limit the eradication of animal diseases. Accordingly more sustainable farming practices will help to internalize costs to the environment.

Research Questions	Main points
	For the dairy sector, land and climate conditions are not well suited to the dairy production, thus driving the expansion of the landless systems. Land acquisition for other non-farm activities, escalating land prices, urban pressure and water security are some of the main factors that impinge upon future dairy growth at local and national levels.
Livestock value chain	**Chapter 3**
What is structured the governance of the Vietnamese livestock sector, in particular the dairy sector?	We use the approach of global value chains to characterize the governance of the dairy sector. The governance of the livestock value chain is defined by characteristics of products, information exchange, enforcement mechanism, dependence level, power asymmetry, captain of the chain, complexity of transactions, codification of information and competence of suppliers.
	The governance of the dairy value chain in Ba Vi (representative traditional milkshed in the North Vietnam) is featured by a mixed relational-captive governance pattern. Relational governance characterizes the two sub-channels in which small-scale industries operate. Captive governance describes the leading role of a medium-size dairy firms that invested in UHT processing facilities and benefited from support of the local government. The local dairy value chain relies on very complex social networks, including dairy producers, collectors, processors, and public authorities
How are the territorial and sector dynamics in the livestock revolution?	The historical development of dairy sector in Ba Vi corresponds to the national trends in the periodized political economy depicted in the Chapter 2: milk production concentrated on State farms (during collectivism period), milk production on individual smallholder farms (during *Doi Moi* period), and recent industrialization of the private dairy sector (since 2008). The processing company, which relies on a large supply network of smallholder farmers, have a major impact on the upgrading trajectory of the local value chain (technology, building industrial farms, quality and certification, etc.). While the cut-and-carry dairy farming has impact on the territory landscape management, the decentralized collection system plays an outstanding role in setting up linkages among local stakeholders. Strong state involvement is underlined in constituting an enabling environment for livestock/dairy stakeholders, especially promoting the public-private partnership in agriculture.
Perspective for the dairy sector	**Chapter 4**
What challenges lie ahead for the Vietnamese dairy sector?	A review on the dairy sector shows the past and current transformation of the dairy sector in Vietnam. Economic and market drivers have favored the development of domestic dairy production. Scale economies are found in the dairy sector. The Vietnamese dairy sector is challenged by efficiency and sustainability issues, i.e. dependency on imported milk and feed, volatility of milk and feed prices, increasing competition from foreign products, land constraint, farm labor productivity and organization, and environmental externality. Among those challenges, the issues of land (for

Research Questions	Main points
	feeding cows), farm labor (family farm versus corporate large-scale farm), and environmental attributes (land, water) are captured and discussed in our quantitative simulations for scenarios
What sustainable models can be promoted in the future?	In the framework of the Revalter project, many discussions and debates have been done around different dairy farming models: (i) large-scale farms as a trend favored by the Government policies to increase milk self-sufficiency and reduce import dependency; and (ii) intensive smallholder production as mainstay of rural livelihood and territory. Considering land constraint factors and other uncertainties, a dual system (mixed crop-livestock) can be promoted to meet key polices of stability and sustainability. This point is linked to the discussion in the Chapter 2.
What are the impacts and policy implications of different scenarios of change?	The participatory scenario planning method is mobilized to explore plausible scenarios for the dairy sector in Vietnam up to 2030. Through stakeholders' workshops at local and national level, 4 prospective scenarios are identified from different uncertainties and dimensions: Mega-farms (MF), Small farms (SF), Dual System (DS) and Dairy Involution Perspective (DIP). The "Mega-farms" scenario examines a situation where domestic milk would be exclusively produced by integrated mega-farms of thousands cows. The "Small farms" scenario is constructed with an exclusive contribution of professional family dairy farms organized in cooperatives and generating a lot of rural jobs in different regions. The "Dual system" scenario is discussed to accommodate different farm models. Finally, the "Dairy Involution" scenario anticipates a situation where low international prices, free trade agreements and low economic growth would result in the disappearing of domestic milk production. Quantitative simulations are then applied to the 3 scenarios underpinned by the domestic production (i.e. MF, SF, and DS) in an aim to anticipate different impacts: herd size and labor productivities, labor costs on farms (economic impact), job opportunities for agricultural workers on dairy farms (social impact), equivalent 'external land' for forage growing or concentrate raw materials and water requirements (indirect environmental impact)
	In the context of a rapid transition of the economy and of the ecosystems, taking account of limited land, smallholders and family farms are still the mainstay of the livestock sector and continue to play an important role in social and environmental development. Appropriate policy actions are needed to ensure the coexistence of the different farms in view of balancing the diversity of supply and demand as well as adapting to the puzzles of local land, labor and environment characteristics.

2.1. The Livestock sector in transition: structural changes incorporated with a multi-level perspective

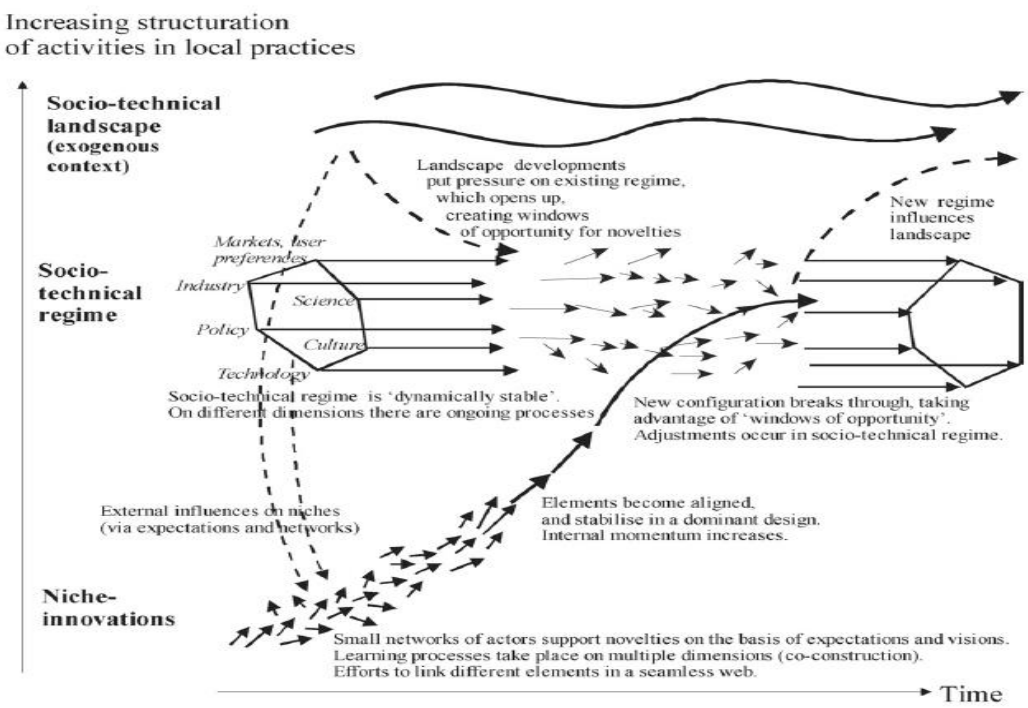
In an agrarian-based country like Vietnam, the livestock development goes in line with the development course and agrarian reforms. The market forces have driven livestock activities in a concentrated manner around cities and in peri-urban areas (Gerber et al. 2005). Structural transformations induced and accelerated by the expansion of secondary and tertiary sectors (industries and services), rapid urbanization and rural exodus to cities are highlighted by the shift of rural labor from farm to non-farm sectors. The income divergences between urban and rural areas, between farm and non-farm population are observed. However, these transformations are not uniform, and rural development is still very dynamic, driven by a number of factors such as land, technology and the agrarian transition.

Land issue: The transition of the livestock sector in Vietnam (dairy sector as an illustration) is driven by the land policies and territorial management. Due to the small farmland (0.8 ha per farm), higher land productivity obtained by livestock activities (compared to crop yields on the same acreage) motivates the shift to livestock activities and intensive livestock. To some extent, the better rural-urban connectivity has favored the peri-urban livestock (the dairy zone in Ba Vi district of Ha Noi is an example). However, the increasing artificialisaiton of land for non-farming purposes has pulled agricultural and livestock activities out of the cities and peri-urban zones. Access to the agricultural resources is the key to form production models (livestock linked to the irrigated crops, livestock associated with rainfed crops, agro-industries, etc.). As Vietnam is short of land, especially pasture land for ruminants and land for feed crops, the disconnection between livestock and land remain a major concerns. With the high animal density, waste treatment is no longer manageable, and social pressure is too high. Livestock concentration zones established at a distance from the residential zones are therefore expected to address negative environmental externalities.

Technology progress: The development of the livestock sector is associated with the technology progress (such as UHT processing technology in dairy sector, the use of TMR for feeding cattle, expansion of cold chain, precision watering, deep litter, agricultural machines, etc.). Also with the improved infrastructure (roads, railways…), the supply chains have been restructured (Chapter 3). The mechanization and automatic processing lines relieve the routine work at the farm level (Hostiou et al. 2012, 2015), but questions the rural employment prospective at the territorial and national levels.

Transformation from the traditional system to the conventional or alternative systems: As for other developing countries, key players of the Livestock Revolution, the ongoing development trajectories of livestock/dairy production lies on the intensification of the agrarian production system (Khanh 2016) and the industrialization of the value chains. The livestock development trajectories can be put in relation with the multi-level perspectives of transition of Geels and Schot (2007) (Figure 5.1). The socio-technical landscape (i.e. structural transformation) constitutes the environment for the niche innovations (i.e. peri-urban agriculture, concentration livestock zones, mega-farms, inputs from nonfarm sectors). To valorize the niche innovations, actors engaged in socio-technical systems (economic actors, institutional actors, market actors, etc.) have gradually been transformed by adopting technological changes and institutional innovations, and altering their behaviors and strategies. The increasing use of industrial inputs (use of industrial feed and concentrates in livestock, overuse of chemical fertilizers and pesticides in crops production, including forage, etc.) for yielding higher productivity has resulted in what can be termed as a conventional agriculture/livestock sector in Vietnam. However, as discussed in Chapter 2, for the sake of sustainable and inclusive development, the notion of "alternative agriculture/livestock" should be promoted, including ecological farming and diversified farming.

Figure 5.1: Multi-level perspective of transitions of Geels (2002)



Source: Geels and Schot (2007)

This thesis embraces economic dynamics at national and local levels and transformation within the agricultural sector with the increased role of the livestock sector and of the larger/commercial farms. While the transformation is often seen from a macro perspective, the microenvironment (territory) and socio-ecological stances contributes to the structural dynamics. The current Government's agriculture and climate change strategy rests on the assumption that the large-scale and modern agriculture, with its intensive production, mechanization and advanced technology, can realistically feed the growing domestic demand and better address the adverse environmental externalities (better diseases control, better waste treatment, standardized quality control, etc.). Yet, under increasing competition from nonfarm sectors and cities (for land, labor and water), over-intensive inputs and natural resource use leave significant consequences on farm profitability, farmer wealth and environment. In this context, besides accelerating sector convergence in terms of income and job opportunities (i.e. Lewis Path), from multi-dimensional standpoints (economic, social and environment) and from multi-functional agriculture perspective (socio-cultural role, ecosystem services) (Viswanathan et al. 2012), *"a paradigm shift from industrial agriculture to diversified agro-ecological systems"* (IPES-Food 2016) in the continuing agrarian transformation and structural transformation has surfaced in the policy discussion and called for further R&D, technology changes and institutional innovations. It should take into account different models of agriculture based on diversifying farms and farming landscape to maintain the agricultural diversification at farm level and to protect small farmers.

2.2. The governance of the livestock sector

The governance of the livestock system goes in line with the dynamics of the agriculture sector. The transformation of modes of governance of the livestock sector (the case of dairy sector in particular) clarify how and why farming systems and territories have changed over the last 30 years. Before the reforms (1986), the governance was centralized (public institutions). After the reforms, we have seen increasing number of social actors (private) delivering public/collective goods and services to livestock. Our analysis of dairy value chain governance in Ba Vi district (Chapter 3) provides insights towards the livestock governance at local level. We share opinion with Salemink (2003) and Clement (2007) that, during the structural transformation and agrarian changes in Vietnam, the State continues to intervene and private actors (farmers or agribusinesses) seem to play an increasing role increasingly in the governance of agricultural systems.

2.3. One shoe doesn't fit all: coexistence and cohabitation of different farm models

In the scenario planning seminars, there has been a widespread consensus about the considerable room for expansion of smallholder dairy production. It is suggested that the rapid human population growth and urban expansion are further reducing land available for livestock production, 'making it impossible to increase livestock numbers'. Although the average margin per cow is high on the large-scale farms, the return per hectare of land may well be lower (with a larger area, a low intensity of production is justified) (Lairez 2012; Khanh 2016). Wages for hired labor per cow may exceed the opportunity costs of family labor used on smallholding. The prospect of the Vietnam dairy sector in the coming decades will be driven by the set of institutional and market factors.

2.3.1. Large-scale farms as a trend favored by the Government policies

Papers presented in the previous chapters (2, 3 and 4) show that the Government has oriented livestock production towards commercial, industrial, large-scale, intensive and modern techniques in its recent policy papers in response to the increasing consumption, to reduce the dependence on importation, and in view of exports. We have seen the emergence of big investments in dairy mega-farms (35000 cows in TH farms, 1000 cows in Future Milk, Hoang Anh Gia Lai, 8 farms of hundreds cows invested by Vinamilk). The vision of these farms (currently 10% of the total dairy herd, 25% of the total milk output) is to secure the domestic demand and reduce the dependence on imported milk powder.

The dairy scale is changing in both developed and developing country groups. Netherlands, for the 1970-2007 period, witnessed increased average farm size (from 16 cows to 65 cows per farm) and reduced number of farms (from 116,000 farms to 21,000 farms) (Demeter et al. 2009). In America, around half of the milk production come from farms with more than 1000 cows[81]. Large-scale operations take advantage of internal and external economies of scale, allow scope for specialization and division of labor, which may result in greater efficiency and labor productivity. They can achieve a higher productivity per cow and per unit of feed. However, this provides no assurance of higher productivity per hectare of land and greater intensity of land use. Studies in the world show that productivity per hectare is negatively associated with farm size. In Vietnam, Lairez (2012) shows that small dairy farmers have higher productivity, and increases in incomes. In any cases, the productive performance of dairy cows varies so much

[81] In the USA, there are 40,000 small family farms, of which many farms of less than 100 cows; and 3,000 farms of more than 300 cows.

between producers, that it would be dangerous to conclude that the large-scale production is inherently more efficient in all respects

In the Vietnam context, characterized by land scarcity and plentiful labor, opportunity costs of the former will be high relative to those of the latter. Large-scale holdings are therefore pressed by the limited land and feed. The potential for expansion of a number of large-scale commercial dairy producers is extremely limited (given increasing population density, land, continuing concerns over the environment). Moreover, the investment per cow is high on the larger farms (capital investment in buildings, equipment, and high quality imported cows). So will high yields and gross margin yield a satisfactory rate of return? This question is raised continuously in media regarding the TH mega-farm of 35,000 cows in Nghia Dan. The farm may face high opportunity costs for land of high potential, where profitable cash crops can also be grown, expensive purchased concentrates, and high interest rates. There is still a debate about the comparative advantage of milk production over the main cash crops (orange in Nghia Dan, for instant)[82]. So, it questions the scope for increasing herd size. Moreover, such an industrial livestock system disconnected from the landscape and from the local feed sources suffer from the burden of imported feed and feed ingredients.

From the environmental perspective, industrial and intensive livestock systems pollute more ground- and surface-water than grass-fed and family systems (Mekonnen & Hoekstra 2012): insufficient land available for safe manure disposal, runoff and leaching of waste into surface and ground water occurs. Large-scale farmland acquisition generally occurs in areas with an abundance of land and weak governance structures, as well as neglect of social environmental issues (World Bank 2011).

2.3.2. Intensive smallholder production: mainstay of the rural livelihood and territory development

Given parallel policy objective of promoting equity, concentration on the smallholder sector has obvious advantages. Regarding labor productivity, intensity of production and labor employment per hectare is high under small-scale production. The smallholder farms create more jobs in the rural areas, so have a greater impact in rural poverty reduction. As long as the rural population continues to grow, employment in agriculture, and other rural pursuits, must increase to absorb these people. Smallholder dairying offers the best prospect for absorbing increasing number of active persons.

[82] Previously converted State-farm own land to TH for dairy production, the main crop in Nghia Dan district is orange growing.

However, there are still some cons of the smallholder livestock. The small dairying system suffers from lack and high costs of grass growing and industrial feed, access to credit at high price, stable market access and especially in those areas far from processing plants, contractual terms and conditions, vet services, risk management and agricultural assurance. These issues interact and limit the participation of producers in the sector. In addition to the limited innovations and investments, intensive smallholder dairying is, by nature, heavily labor using in daily hand-feeding, milking, calf rearing and regular hygiene and health measures. Opportunity costs of labor are higher in the more densely populated high-potential zones (peri-urban) where opportunities for alternative productive activities are greater.

2.3.3. Coexistent and cohabitation of different farm models to continue

On these above grounds, a strong case can be made for the Government policies aimed at facilitating the growth of dairy industry, within the process of general economic development. If the choice had to be made between promoting large-scale/small-scale dairying solely on the basis of relative productive efficiency, it would be difficult.

In Vietnam dairy industry, it is difficult to measure the relative productive efficiency of large-scale and small-scale production, especially in the crop-livestock system. In such mixed system, how to adopt “integrated landscape management” (Reed et al. 2015) to alleviate the problems of allocating resources among competing alternative uses? Dairying, as a form of mixed crop-livestock farming, contributes to meeting other key policy objectives of stability and sustainability. Stability is promoted by keeping animal, which serves as a form of insurance (activity diversification, total income derived from diversified, mixed system will be more stable than that from specialization). Sustainability is promoted because of the mixed crop-livestock system, involving the feeding crop residues and the application of manure to the soil, ensuring some nutrient recycling, and is less likely than specialized systems to result in nutrient deficit of supplies. Livestock manure can be a positive contributor to soil fertility and land management in more extensive mixed farming systems. It is the concentration of huge quantities of livestock waste in given areas that converts it into a negative environmental impact in industrial systems. The dual system is geared towards securing and stabilizing agro-ecosystems to enable them to remain productive over time, rather than maximizing short-term yields of a specific crop. Existence of different farm models will be available but the composition/proportion depends on the scenario and the nature of production system as well as the collective action and policy intention of local and central government.

3. Policy insights on sustainable livestock development

3.1. Which farm size is optimal?

Despite the land reforms, small farms dominate. In the new setting of industrialization and livestock revolution, the place of small farms is highlighted the policy debates. But no definitive policy of the optimal structure in Vietnam is put in place. The current policy vision just mentions prioritized supports to larger farms. Challenges face policy makers in defining an appropriate and relevant dairy farm size taking into account balancing efficiency and equity, lowering production costs and create increasing added value earned by dairy farmers. Mrs Pham Huong, officer of the Department of Livestock Production (DLP/MARD), in her contributions to our scenario planning seminar on 1st April 2015, gives her positive view towards dairy farms of 15 cows minimum to have a more sustainable growth (herd management, quality control, waste management, etc.). This point was also shared by Mr. Tang Luu, Director of Bavi Forage and Cattle Research Center (BVFCRC). However, it still lacks scientific evidence to convince about the benchmark of 15-cow herd. While the consensus hasn't been reached among involved stakeholders (policy makers, scientists, development practitioners, etc.), both public and private sectors have still launched regulations and protocols vis-a-vis promoting large-scale farms to be responsive and well-prepared for the competition pressure from foreign companies (VERP 2015).

Vimamilk, the leading company in the Vietnamese dairy industry, has set a development vision for the 2017-2020 period to apply to their material zones across the country (Protocol 1948/CV-CTS.PTNT dated on 6th May 2016). Accordingly, the company requires the dairy barn facilities out of residential and industrial zones. As IDP's procurement strategy, Vinamilk only commits to buy milk from contracted farms which pre-register their dairy herds to the company (number of cows and lactating cows). Regarding the herd size, Vinamilk prioritizes farms of 50 cows and above and encourages small farms associated in farmer groups and cooperatives. The company also sets timeline for its procurement agenda: only contracting farms of at least 5 cows in 2017, at least 8 cows in 2018, at least 12 cows in 2019 and at least 15 cows in 2020. Recommendations on barn management and environment control are also present in the Protocol.

Recently, the Department of Livestock Production has issued an official instruction on recommended solutions for sustainable livestock development[83]: (i) only building up dairy farms upon the presence of dairy companies in the locality, and available contracts signed with processing companies; (ii) farms having the land surface of forage and maize biomass for 10-12 cows per hectare; (iii) herd size at farm level: at least 8 lactating cows on small farms (*"nông hộ"*), and at least 20 lactating cows on commercial farms (*trang trai*) (for investment recovery and mechanizing routine tasks). It is also anticipated that the expansion of dairy goat production will be observed (based on exotic breeds (Saanen, Nubien, Alpine…) and hybrid breeds that adapt to some local farms); streamlining investment in the production infrastructure facilities (raising, collecting, processing), market explorations (hi-end distributions: markets, restaurant...), and diversification of products (milk, cheese, yogurt).

The diverse perception, behaviors and strategies of different actors at different level (*Box 1* in the Introduction) illustrate a multi-color landscape of the dairy sector in Vietnam. Our proposed scenarios (in Chapter 4) bring further insights to the structural composition of dairy farms. The farm diversity remains, the importance of larger and industrial farms is more weighted, but the choice of an optimal farm size should be defined according to dairy zoning (upon different local natural, agronomic and socio-economic conditions). Further studies on performance of dairy farms of different sizes in different miilksheds are needed to specify appropriate and optimal farm sizes to be supported in the future.

3.2. Land for food and Land for feed

Food shortages in the early years of *Doi Moi* (late 1980s) in Vietnam upheld the adoption, for nearly 30 years, of a 'rice-first' policy (World Bank 2012; Quynh 2016), which is supported by land policies stabilizing paddy land and putting restriction on alternative uses of agricultural land (World Bank 2016). Now, the paddy production has proved able to feed Vietnam's 90 million population and is the major export industry. Vietnam exports around 7 million tons of rice every year (OECD 2015; GSO 2017). Rapid growing domestic demand for animal products has driven the booming livestock production in Vietnam, which in turn has led to the rapid growth in demand for protein feedstuffs and feed raw materials. The factor influencing growth of demand for feed-grains and forage/fodder is the increase in the rate of production growth for poultry, pig and dairy cattle recently. Vietnam has not been able to meet its demand for livestock maize and soybean feed from domestic production. Vietnam has been emerging as a net importer of

[83] Official Document 939/CN-GSL 26/06/2017

biomass for both human food consumption and animal feed. Food sufficiency doesn't imply food security (Warr 2006), and also challenges "feed security" (World Bank 2016). The agrarian system and *"food security concerns are likely to be increasingly tied to the cost and availability of animal feed and the performance of a livestock sector now going through a major restructuring*" (World Bank 2016).

The decreasing terms of trade of rice production have encouraged Government to reconsider its 'rice first' policy and opt for supporting crops diversification through the recent policies favoring the shift of paddy-land to alternative agricultural land and eco-systems services. The current Government policy still sustains 3.8 million ha of arable land for rice production. However, taking into account the land constraints and facilitated by the specialization of agriculture and intensive concentrated livestock, some recent central and local policies (Box 2) have stipulated the temporarily conversion[84] of paddy land to other cash crops (Table 5.2), prioritizing maize and soy, which Vietnam now imports in large quantities to serve livestock production (Vietnam imported nearly 7.6 million tons of maize in 2015, increasing by 71.2% compared to 2014 (MARD 2015)). Cultivation of cash crops like maize, soya, potato produces important sources of agricultural byproducts which are important components in the ration for animals as well as source for feed industry. However, the debates on "land for food" and "land for feed" persist as local experts still doubt the efficiency of this conversion, in terms of competitive prices and quality of locally produced maize and soy compared to imported products. Higher production costs and lower quality explain the preference of feed companies and livestock producers for imported maize[85], and therefore the internal trade balance is still likely to come into question. In this respect, much will be done to facilitate effective conversion of paddy land to alternative crops in an efficient and sustainable manner, i.e. efficiency of resource use, supporting policies, output market for farmers, supporting services, post-harvest technology, improved infrastructure, etc.

[84] It means that this arable land can be reverted to growing paddy as soon as the country faces difficulty of food availability (i.e. food shortage)

[85] This point was shared by Madame Nhu, Head of Technincal and Quality Control of Invivo Feed Company (Revalter field visit, October 2014).

Box 2: Governance of agricultural land use: Recent major land policies

Decision 824/QD-BNN-TT (16th April 2012)[86] and Decision 1006/QD-BNN-TT (13th May 2014)[87] of the MARD referred to land for feed crops: it was planned to increase land for feed production to 100,000 ha in 2015 and 300,000 ha in 2020 (i.e. rice land would be kept at 3.899 million ha in 2015 and 3.812 million ha in 2020).

Decision 3367/QD-BNN-TT (31st July 2014) of the MARD specified the roadmap for converting rice production land to other crop production.

Decree 35 (13 April 2015) enhanced the flexibility of rice-land with a provision rice-land under which it can more easily be put to alternative agricultural uses, including the cultivation of other seasonal crops and aquaculture. This is likely just the beginning of a major reform to come with respect to the governance of agricultural land-use.

Table 5.2: Plan for converting rice land to other crop production (2015-2020)

(in 1,000 hectare)

	2014-2015	2016-2020
Total paddy-land area to be converted to other crops	260	510
By "targeted" alternative crops		
Maize	80	156
Soya	16	33
Sesame, peanut	41	54
Flowers and vegetable	51	116
Feed crop	13	37
Other crops	24	58
Aquaculture crop	35	56
By region		
Red River Delta	42	87
Northern Mountains	15	85
North Central Coast	26	34
South Central Coast	49	56
Central Highlands	4	10
Southeast	14	34
Mekong River Delta	112	204

Source: MARD, 2014

3.3. Governance of the production system of diversity

The analysis of the value chain governance (Chapter 3) underlines the role of public stakeholders and their connection the private sector in governing the value chain and its performance. The strategy of upgrading the value chain should lie on the fairer distribution of added value among value chain actors, diversification of products, improved marketing of milk, and improvement of efficiency by reduction of transaction costs, and concrete institutional arrangements. The central and local government have to adopt "leading less, facilitating more approach" (World Bank 2016), i.e. the role of the

[86] Decision of MARD on approving the Plan for crop production development to 2020, vision 2030
[87] Action plan on restructuring the crop production sector in 2014-2015 and 2016-2020 period

government is transferred from actor to facilitator/regulator/supervision by issuing the norms and regulations to oversee the sector. Policy instruments for promoting the development of the livestock sector (dairy industry in particular) fall under 3 main headings: *prices* of inputs and outputs, *market liberalization* facilitated by policies to maintain competitive market conditions, or to avoid the development of monopolies, to establish quality standards, and to promote the spread of appropriated institutions and governmental norms; *address protein feed deficit* by strengthening domestic feed and animal industry competitiveness and minimizing effects of feed prices hikes on the domestic food system. Moreover, in a agro-ecological system involved by a diversity of farms characterized by various resource endowment (Duteurtre et al. 2015; Khanh et al. 2016; Cesaro 2016), the policy agenda should come up with different ingredients for different farm systems: farms accessible to irrigated crops, farms associated to the rainfed crops, and agro-industrial farms supplied by bought feed.

3.4. Integrating economic, social and environmental factors in livestock development

Discussions on the sustainability of the livestock sector hang over a number of dimensions and criteria, and participative construction of different sector and territorial actors and stakeholders (Lairez et al. 2015). Not only the assessment of sustainability but also the policy-making process should involve and engage different actors, both farmers and other territory actors (association, researchers, civil society representative), through focus groups, expressing their experiences, expertise and expectations.

The Livestock Revolution and the rapid expansion of industrial, concentrated large-scale and mega farms in the dairy sector (and also in other livestock activities) underline necessary policies to regulate intensive and industrial livestock operations and support environmental and economically sustainable farming practices. From our scenario planning exercise (Chapter 4), the policy makers need to take account not just economic dimensions but also labor, land tenure, feed and environmental indicators to promote a sustainable future of dairy farming in Vietnam. National and local government will have to continue their supports to mega-farms (via favorable land policies, technology) but also family farming (via access to credit, technical assistance, and infrastructure building, etc.). National environmental legislation and regulations include setting standards for effluent discharges and emissions and provide framework of codes of conduct for farms at local and regional levels.

4. Limitations of the thesis and perspective for further studies

The thesis tries to capture the dynamics of agriculture, especially the livestock sector (with a focus on dairy production) and dynamics at the district level of the contemporary structural transformation in Vietnam. However, the study reveals some bottlenecks that call for further and in-depth researches.

4.1. Limitations of the thesis

4.1.1. Indicators captured in the scenario planning to adapt to the local dairy sector

a) Economic sustainability

Vietnam dairy markets is price-sensitive. Currently, local processors gain market shares from imported products, thanks to support from the national and local authorities. However, competition pressure is rising from more value added products of imported brands. Our simulations haven't captured the price dynamics of different dairying systems.

Production cost is considered a good indicator for showing the economic performance (more viable than the gross revenue). Higher production costs negatively affect the sustainability of dairy farms (Chand et al. 2015). However, impossible access to Balance Sheets of the mega-farms (under control of big companies) and absence of temporal monitoring at farm levels (family farms) prevent us from a more detailed analysis of production costs. We also lack formula allocating feed (forage/concentrates) by farm categories.

b) Social sustainability

Dairy farming is a source of employment in rural areas, especially in the developing countries of different contexts (Faye and Duteurtre 2009). In this simulation exercise, we just take into account the number of jobs created on farms. The burden of work (expressed in working hours) are not proxied in our simulations. It is a limit of the job, as the working hours can reflect the other livelihood properties of farmers (leisure, time for other employment)

c) Environmental sustainability

The thesis just captures the indirect environmental impact from the dairy production (external land from milk-exporting and feed-producing countries that ship to Vietnam). Other direct impacts are not reflected. Khanh (2016) analyzed the sustainability at farm level from the quantity of fertilizers and pesticides used for each hectare of forage in Ba

Vi (as these inputs pressure the land and water sources). However, these indicators are only relevant for the family farms with land for livestock. In the landless dairy system, especially in the mega and concentrated industrial farms, it is difficult for us to consolidate and quantify the data.

Other indicators by farm size (use of biogas, compostage…) are heterogeneous as such systems are different from each other. While TH Milk applied the modern waste treatment, the small family dairying use the traditional one. So harmonisation to quantify impacts poses difficulties.

4.1.2. Local scope of scenario planning

The scenario planning exercise at local level (in Ba Vi district) is not totally representative of the other milk dairy sheds in Vietnam. Nevertheless, it gives potential to work on scenario planning for the other production systems at local level if local authorities are interested. The local scenario planning enables us to articulate diversified dairy systems in terms of natural diversity, operational production system, and the connection between different actors, the contact between local government and local actors. While dairy farmers in Ba Vi districts have little land for forage production and still depend on external feed, dairy farmers in Moc Chau or Lam Dong have larger forage land and conduct different practices. Meanwhile, dairy farmers in Cu Chi (in Ho Chi Minh city) feed their herd all with bought industrial feed but they receive strong supporting services from local cooperatives. Therefore, to characterize the more viable scenarios at national level, it would be interesting to do local scenario planning in other milksheds (like Moc Chau, Lam Dong, Cu Chi) in an effort to identify further uncertainties, dimensions, prototypes of farms, supporting services, marketing channels, etc. Moreover, it is critical to track the agribusiness (milk companies) and their visions and strategies for the future.

4.2. Perspective of further and complementary research

On-farm labor: Under the rapid structural transformations, rising agricultural wages and private investment would encourage mechanization in agriculture and livestock production. To support this vision, we need to conduct some more farm surveys to capture economic trends and identify the right income and investment thresholds. A better knowledge on the employment dynamics in livestock (dairy) farms would allow us to understand more fully household investment behaviors in relation to agricultural transformations.

Farm trajectories: Currently, since most of the dairy farms in Vietnam are smallholders, the production practices are quite homogeneous. However, there are significant differences in technical performances (Khanh 2011). It seems necessary to better assess the performances and the strategies of small and larger farms, in order to make better simulations for future prospects as well as to identify further actions to support farm development trajectories (Choisis et al. 2008; Aubron et al. 2009).

Analysis of environmental impacts: The thesis tries to capture a 'snapshot' of indirect environmental impacts resulting from different stages of the system in form of "equivalent external land" for forage/concentrate crops to be used to feed livestock. A number of consequential impacts could be estimated from these "external land", such as GHG emissions caused by deforestation for expansion of soy cultivation, etc. (FAO 2010). Therefore, besides required additional in-depth exercises capturing market forces (international and domestic prices) farming practices (ration and technology by farm types) (i.e. economic impact), direct environmental costs through Life Cycle Analysis (LCA) of different systems are needed to quantify the consequences of scenarios.

Impact evaluation of expansion of large-scale livestock operations: We are seeing more and more large-scale and mega farms in the livestock sector. In the future, it is very useful to conduct in-depth assessment of economic, social and environmental impacts brought by the installation and expansion of such operations at the territory level. Further knowledge about these economies of scale is deemed to bridge research and policy.

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ANNEX

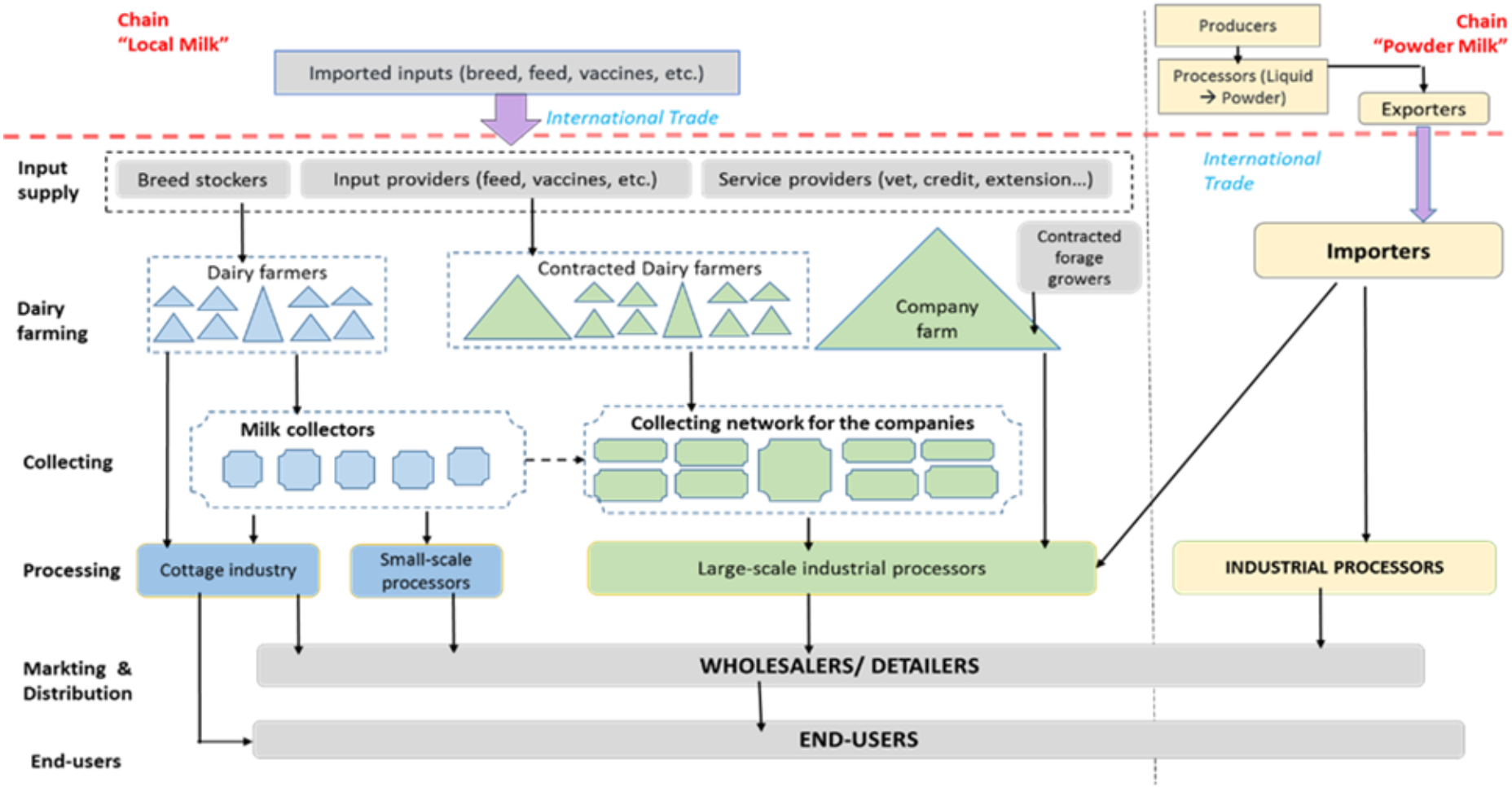
Annex 1: Policies supporting Livestock and Dairy Sector

Legal Document Number	Key content
Decision 167/2001/QD-TTg of Prime Minister applying some measures and incentives to develop dairy cows for the 2001-2010 period *(26th October 2001)*	The Decision aimed at developing dairy cow production to a production target of 350,000 tons of fresh milk by 2010, or about 40 percent of domestic demand, to reduce the dependence on the world milk market, generating employment, increasing farmers' income, facilitate the structural transformation in rural areas. Targeted provinces: 29 provinces and cities (North region: 11 provinces; South region: 8; Central Coasts: 6; Central Highlands: 4). These provinces were included in the Project "Development of dairy breed for the period of 2000-2005" (MARD, 2000)
Resolution 03/2000/NQ-CP of the Government on development of commercial farms ("*trang trại")* *(02nd February 2000)*	Commercial farms are characterized by market-oriented commodity production in agriculture. Commercial farms develop based on the economies of scale in view of efficient use of resources, higher income and improved livelihood for farmers. The Resolution presents policy priorities for commercial farms, including: land policy (including land consolidation), investment incentives, technical assistance and technology transfer, extension services,, support to credit access, linkage and connection among sector,
Resolution 09/2000/NQ-CP f the Government on some visions and policies on shifting production and consumption of agricultural products. *(15th June 2000)*	The dairy cow production was prioritized in the midland and mountainous areas. It was expected to have a herd of 200,000 cows (100,000 lactating cows) and a total milk volume of 300,000 tons raw milk for processing in view of relieving imports after 10 years (i.e 2010) (*cf. Point b, article 6, section I*)
Decision No.22/2005/QD-BCN of the Ministry of Industry, on approving master plan on development of milk industry in Viet Nam till 2010 and planning to 2020; (26th April 2005)	The Master plan's target is to increase indigenous production in order to meet per capita consumption of 8 kg in 2005, 10 kg in 2010 and 20 kg in 2020. The self-sufficiency ratio shall be 20% in 2005 (140,000 MT.) and 40% in 2010 (300,000 Mt.), and around 1,000,000 Mt. by 2010, and satisfy 50% of domestic demand by 2020; Milk processing: increasing the processing capacity by 120 million liter/year during 2001-2005; by 228 million liter/year during 2006-2010; Localization of milk processing facilities: prioritizing investment in some facilities of large scale in concentrated dairy farming in Southeast, Red River Delta, Central Coasts; Small processing facilities (4-5 million liter a year) are installed

Legal Document Number	Key content
	in other zones of small dairy herd (Northern midland and Mekong River Delta)
Decision 10/2008/QD-TTg on approving the **Strategy for livestock development to 2020** *(16th January 2008)*	Targeted production for dairy farming: - Dairy herd: 2010: 200,000 cows; 2015: 350,000 cows; 2020: 500,000 cows - Milk production: 2010: 380,000 tons, 2015: 700,000 tons, 2020: 1,000,000 tons - Per capita milk supply: 2010: 4.3kg; 2015: 7.5 kg; 2020: 10kg Farming model: industrial-scale farm, commercial farms ("*trang trại*")
Decision 3399/QD-BCT dated on 28th June 2010 of the MOIT on approving master plan on development of milk industry till 2020 and planning to 2025; *(28th June 2010)*	The Master plan's target is to raise the domestic production to satisfy per capita consumption (2015: 21kg, 2020: 27kg and 2025: 34kg). The self-sufficiency is planned to be 35% in 2010 (600 million tons), 38% in 2020 (1 million tons) and 40% in 2025 (1.4 million tons) Targeted domestic processing: in 2015: 1.9 billion liter fresh milk equivalent; in 2020: 2.6 million liters; in 2005: 3.5 liter fresh
Decree 210/2013/ND-CP dated on 19th December 2013 of the Prime Minister on encouraging private investment into rural and agricultural sector *(19th December 2013)*	The Decree stipulates investment incentives (land lease, technology, finance, etc.) that enterprises can benefit In case of dairy production (*c.f. Article 11*), conditions are listed as: farm project of at least 500 cows of high productivity, farms built up in planned zone, compliance with all environmental, veterinary and food safety norms as regulated, and utilization of at least 30% of local employment. Support incentives: - 5 billion Vietnam dong (equivalent to 250,000 USD) per project for building infrastructures and facilities (waste treatment, roads, electricity, housing, forage and equipment's). - Additional funds can be financed for operations installed in areas without road, electricity, water systems; - For importing dairy cows: 10 million VND (500 USD) per cow in provinces having herd of more than 5,000 cows; 15 million VND (750 USD) per cow in other provinces
QD 124/QD-TTg of the Prime Minister approving Master Plan for agricultural development to 2020, vision 2030 *(02 February 2012)*	Master plan for agricultural land use toward 2030: - Paddy: 3,8 million ha, 41-43 million tons; - Maize: 1,44 million ha; 80% output for feed industry - Soy: 350 thousand ha, 700 million tons - Feed crops: 300 thousand ha

Legal Document Number	Key content
	Zoning for dairy production: peri-urban area and some regions of favorable agronomic conditions. Dairy herd: 500,000 cows by 2020
Decision 899/QD/TTg of the Prime Minister on approving the **Agricultural Restructuring Plan** toward higher added value and sustainable development *(10th June 2013)*	Livestock models: gradually transformed from scattered and smallholder livestock to concentrated, professional and commercial farms Livestock zoning: localizing livestock zone from high-density population regions (the deltas) to low-density population regions (midland, highland); building livestock concentration zones; Value chain governance: application of high technology, establishment and strengthen linkage among actors in the value chains, upgrading value chain, support integration models Supports for family farms applying industrial model Strengthen monitoring system of animal diseases, environmental management system
Decision 984/QD-BNN-CN of the MARD on approving the **Restructuring Plan for Livestock sector** toward higher added value and sustainable development *(09th May 2014)*	The Restructuring Plan for livestock sector (DLP, 2014) bases on 4 key axes *(i) restructuring production by region* by shifting large-scale livestock farming from high population density to low population density to form concentrated livestock zone in distance from residential areas; *(ii) restructuring production by product patterns* by cutting pork and increasing other livestock products; *(iii) restructuring production by farming mode* by shifting from family livestock farming to commercial farming under good control of food safety and environmental management; *(iv) restructuring production by value chain linkage* by highlighting role of enterprises and production entities. The Plan also absorbs measures on land management, credit et taxes, trade issue (longer term for land lease, tax privileges for importing feed ingredients, simplified trading procedures, quality control norm, etc.)
Decree 55/2015/ND-CP on credit for agricultural and rural development	Under this Decree, farmer, farmer group, cooperatives, etc. that invest in agricultural activities (production, trading,…), even without mortgage assets, can get credit from government. In the livestock sector, the maximum credits ranges from 100 million (5000 USD) for individual farmer, 300 million (15000 USD) for farmer group and 1billion VND (50,000 USD) for cooperative or commercial farms.

Annex 2: Dairy value chain in Vietnam



Annex 3: Profiles of key dairy companies in Vietnam

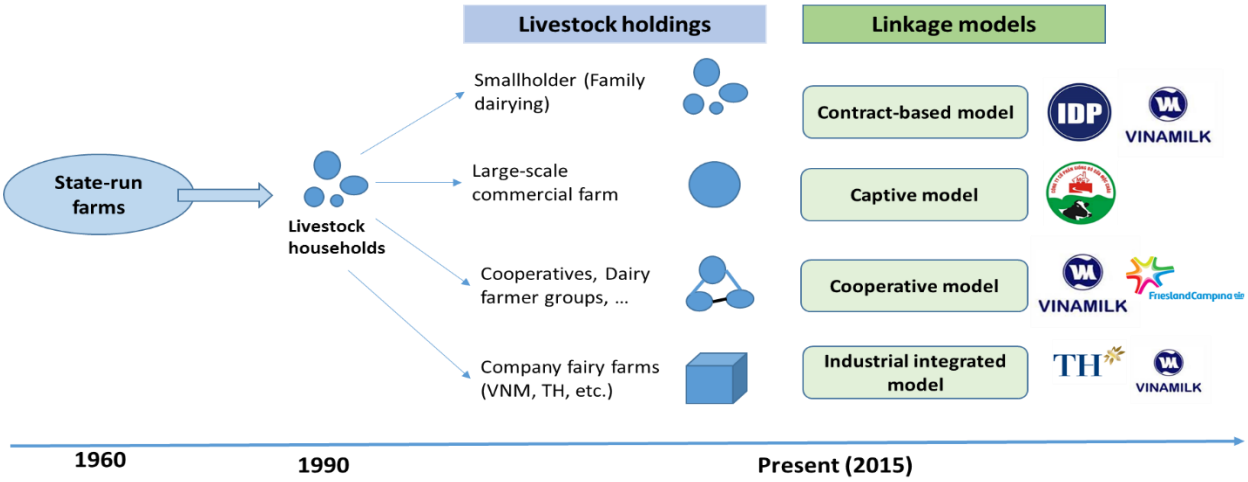
	VNM	Dutch Lady (FCV)	TH Milk	IDP	Moc Chau
Cow herd	120,000 (65,000 on HH farms)	30,000	37000 (2015)	8000	~ 20,000
Affiliated farmers	8,000 farms (37% demand)	~3100 farms (15% demand) 2500 farms?	0	~ 2000	600 farms (50% demand)
Colleting points	91	39 company-affiliated collectors	0	14 Private collectors	19 collecting points
Processing plants	10	2 (Binh Duong and Ha Nam)	1	3	2
Employees	4,000		1,000		~ 2000
Procurement channel	Direct importer; Purchase from local farmers	Direct importer; Purchase from local farmers	Milk from its own farm	Direct import; Purchases from local farmers	Supplies from satellite farms; 3 company's farms
Local distribution system	[88]220 head distributors; 14 showrooms; 14,000 retail shops; 170000 retail points,	[89]7 head distributors; 145 wholesalers, 80000 retailers, 150000 retail points	TH Marts		Branch (Hanoi); ~200 sale agents; 2000 retail points
Targeted markets	Domestic; Export	Local	Local (North)	Local	Local (North)
QAS in place	HACCP, ISO 9000,	HACCP, ISO 9000, ISO 22000	--	ISO 22000	HACCP, ISO 9000
Product range	Liquid milk, UHT milk, condense milk, yogurt, formula milk, ice-cream	Drinking milk, UHT milk, powder milk, condensed	Liquid milk; Yogurt	Pasteurized milk; Yogurt; UHT milk; Nutritional drinks	Pasteurized milk; UHT milk, cheese, butter, milk cake
Brand-name	Vinamilk, Ong Tho, Dielac, Flex, Susu…	Dutch Lady, Yomost, Friso…	TH True Milk; TH True Milk yogurt; TH TOP Kid	Ba Vi, z'Dozi; Love'in farm; Kun	Moc Chau
Contractual relationship with farmers	Yes	Yes		Yes	Yes (tenant)
Chain captain	Yes	Yes	Yes	Yes	Yes
Integration level	Partially integrated structure	Partially integrated structure	Total integrated structure	Partial integrated structure	Vertical integration by processor

[88] Vinamilk, 2013
[89] Dutch Lady, 2013

Annex 4: Linkage models in the dairy sector in Vietnam

Some linkage models in curent operation are illustrated in the following chart. Besides independent smallholder dairy farms who sell their milk in the spot market, thousands of farms integrate in the value chain through contracts with businesses. The linkage between dairy farmers and companies can be fall into one of three forms: contractual model, captive model, cooperative linkage, and integratead industrial model.

Linkage models in Vietnamese dairy sector



Source: Author's synthesis

- ***Contract-based model*** (IDP in Ba Vi/Hanoi)*:* IDP signs annual contracts with dairy farmer supplying milk to their factory. The contract-system based system of IDP is analyzed in the Chapter 2 of the thesis. Besides IDP, Vinamilk also has a network of dairy smallholders contracted with them. The companies set procurement conditions and all milk quality tests are done at the companies' place.

- ***Captive model*** **(**Moc Chau milk in Moc Chau/Son La) is depicted by the completedly ownership of the only company, Moc Chau Dairy Cattle Breeding Joint-Stock Company. The company organizes all milk production activities in their area of 1600 ha natural land (of which 968 ha agricultural land): milk farming, milk collecting, and milk processing. Dairy farming and forage growing are done by 565 contracted farms with a herd of around 15,000 dairy cows (28 cows per farm on average)[90]. The company is in charge of all input supply (breeed, technique, etc.) et technical assistant to their associated dairy farms who engage in the system as agriculturla workers. Moc Chau JSC

[90] In 2012: 12,000 cows; around 500 farms (3 farms with more than 100 cows; 100 farms with more than 50 cows; 400 farms of smaller scale). In 2015: 18,000 cows, on average: 30-32 cows/farm (biggest farm: >200 cows); 180 tons/day, 7.4tons/cycle

is also the ownership of the mark 'Moc Chau milk' (*sua Moc Chau)*. In paralelle with contracted dairy farming, the company introduces other incentives such as loans for dairy extension (buying cows, building housing facilities, growing forage, etc.) up to 50% of the needed investment with privilage interest rate, feed provision, training, livestock service, monthy premium on milk prices. Especially, insurance schemes have been applied. Animal insurance can help dairy farms to buy replacement calves or dairy cows by insurance compensation plus earnings from beef sale[91]. Milk price insurance[92] is considered as price stabilization measure as soon as the purchase prices are down. Another stratery of Moc Chau JSC. is contracting with local farms in forage production. The company buys every year 100000-200000 tons of fresh maize (whole plant for fermentation), around 100000 tons of dried corn and dried casava to pruduce concentrated feed for dairy cattle. Stable income from dairy farming and more than 1000 local jobs generated show Moc Chau Milk as a good example of inclusive business.

- ***Cooperative model*** (Vinamilk's cooperatives in HCMC, FCV's Evergrowth cooperative in Soc Trang). Dairy cooperatives are popular in Ho Chi Minh City, such as Tan Thong Hoi Dairy Cooperative, Thanh Cong Dairy cooperative (Cu Chi), Hoa Loc gricultural Cooperative, Tien Thanh Dairy Cooperative, etc. Dairy cooperatives are set up based on the mutual interest of local dairy farmers. Cooperative members do dairy farming and sell milk to cooperatives which perform all livestock service provision to their member. Cooperatives play the intermediate role in connecting dairy farmers and processing companies like Vinamilk. Vinamilk also has linkage with agricultural cooperatives in other provinces (such as Long Hoa Cooperative in Can Tho)[93]. Evergrowth cooperative, which operating on the basic of 1800 members, 5000 dairy cows, provide milk for FCV. The cooperative provides technical support and absorbs milk produced by the members and local dairy farmer groups for FCV's processing plants.

Cooperative is formed from a natural aggreagion and concentration of family dairy farms in the commune/district. These cooperatives are focal points to provide services to farmers as well as to promote milk collection and handling milk for processors. Bargaining power of the dairy farmers are enhanced. The investment of Vinamilk is considered well-organized, based on the basis of sustainable market, domestic market developmet as a driver of the extension of export market.

[91] Animal insurance: insurance fee = 600,000/cow/year. Death cow is compensated 12,000,000 VND/cow; Culled cow is compensated 10million VND. The compensation adding to the sale of beef will enable farmers to buy a new calve

[92] Milk price insurance: insurance fee = 50VND/kg. In case of low prices, farmers will be subsidized by company 60%

[93] Vinamilk procures 70-80% of local milk production. The cooperative has 245 dairy cows, of which 120 lactating cows that produce 11400 kg milk a year.

- ***Integrated industrial model*** (TH Milk in Nghia Dan/Nghe An, VNM in Thanh Hoa[94]) is characterized by the closed production – processing process. The contraction of smallholder dairy system, coupled with open-market opportunities, has led to the development of intensive system. The system is characterized by the larger farm size of 500 cows or above per farm, building better stall-feeding system, purchase of straw, concentrated and green feed, use of capital-intensive infrastructure, well-organized marketing systems and better access to markets). The companies handle all stage of value chain: input provision (breed, techniques, managment, land, etc.), dairy farming, milk collection, transportation, processing, distribution and marketing. Differently from Vinamilk, emerging TH Milk is associated with giant investment in high technology, backstop of loans (Isarelli financing and credit of commericla bank, no export-oriented production, and unavailabiliy of sustainable feed supply produced domestically).

[94] Dairy farm of 1500 dairy cows in Sao Vang (Thanh Hoa) – Dairy processing factory of 40-million liter installed capacity, and of 2-million liter output a year in Le Mon Industrial Zone (Thanh Hoa)

Annex 5: Article on a Vietnamese journal

Tittle: Orientation towards sustainable development of the dairy sector in Vietnam: smallholder farming or intensive large-scale investment?

Tittle (in Vietnamese): Hướng đi nào bền vững cho chăn nuôi bò sữa ở Việt Nam: Chăn nuôi nông hộ hay trang trại quy mô lớn?

Authors: Nguyen Mai Huong[(1)], Jean-Daniel Cesaro[(2)], Pham Duy Khanh[(1)], Hoang Vu Quang[(1)], Guillaume Duteurtre[(2)]

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Summary

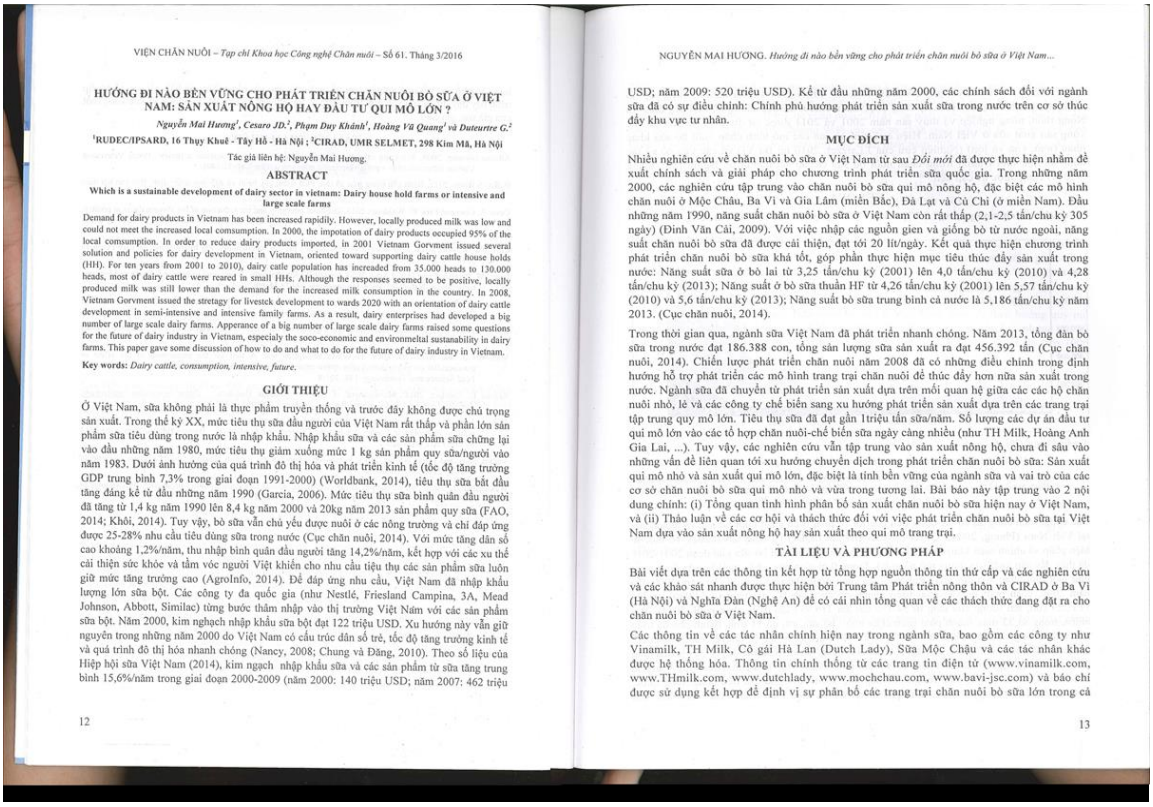
The demand for dairy products has been increased rapidly in Vietnam, however the domestic production hasn't been able to feeding this growing market. In 2000, imports of dairy products accounted for 95% of the domestic consumption. In order to reduce the dependency on imports, the Vietnamese Government, in 2001, launched a number of policies supporting dairy development with a focus on smallholder farming. Between 2001 and 2010, the dairy herd increased from 35,000 to 130,000 cows, mainly raised on smallholder farms. Despite these positive results, the local milk production was still insufficient to meet the growing demand. The Government's Livestock Development Strategy to 2020, issued in 2009, emphasizes development orientation towards large-scale dairy farms and (semi-) intensive dairy production. Dairy enterprises has built up a number of large-scale industrial farms. The emergence of large-scale farms and mega-farms questions the future of the dairy sector in Vietnam, especially the social, economic and environmental sustainability of dairy farming

***Keywords**: Dairy cattle, consumption, smallholder farming, intensive production, megafarms*

Résumé

La demande de produits laitiers a rapidement augmenté au Vietnam, mais la production domestique ne satisfait pas la demande. En 2000, les importations de produits laitiers représentaient 95% de la consommation intérieure. Afin de réduire la dépendance à l'égard des importations, le gouvernement vietnamien a lancé en 2001 un certain nombre de politiques en faveur du développement laitier axées sur les petites exploitations. Entre 2001 et 2010, le cheptel laitier est passé de 35 000 à 130 000 vaches, principalement élevées dans les petites exploitations. Malgré ces résultats positifs, la production locale de lait reste inférieure à la demande en croissance. La Stratégie de développement de l'élevage du gouvernement jusqu'en 2020, publiée en 2009, met l'accent sur l'orientation vers le développement des exploitations laitières à grande échelle et de la production laitière (semi-) intensive. Les laiteries ont construit un certain nombre de fermes industrielles à grande échelle. L'émergence de grandes fermes et de méga-fermes interroge l'avenir du secteur laitier au Vietnam, en particulier la durabilité sociale, économique et environnementale de l'élevage laitier.

Mots-clés: *Vache laitière, consommation, agriculture familial, production intensive, méga-fermes*



VIỆN CHĂN NUÔI – *Tạp chí Khoa học Công nghệ Chăn nuôi* – Số 61. Tháng 3/2016

HƯỚNG ĐI NÀO BỀN VỮNG CHO PHÁT TRIỂN CHĂN NUÔI BÒ SỮA Ở VIỆT NAM: SẢN XUẤT NÔNG HỘ HAY ĐẦU TƯ QUI MÔ LỚN ?

Nguyễn Mai Hương[1], Cesaro J.D.[2], Phạm Duy Khánh[1], Hoàng Vũ Quang[1] và Duteurtre G.[2]

[1]RUDEC/IPSARD, 16 Thụy Khuê - Tây Hồ - Hà Nội ; [2]CIRAD, UMR SELMET, 298 Kim Mã, Hà Nội

Tác giả liên hệ: Nguyễn Mai Hương.

ABSTRACT

Which is a sustainable development of dairy sector in vietnam: Dairy house hold farms or intensive and large scale farms

Demand for dairy products in Vietnam has been increased rapidily. However, locally produced milk was low and could not meet the increased local consumption. In 2000, the impotation of dairy products occupied 95% of the local consumption. In order to reduce dairy products imported, in 2001 Vietnam Gorvment issued several solution and policies for dairy development in Vietnam, oriented toward supporting dairy cattle house holds (HH). For ten years from 2001 to 2010), dairy catle population has increaded from 35.000 heads to 130.000 heads, most of dairy cattle were reared in small HHs. Although the responses seemed to be positive, locally produced milk was still lower than the demand for the increased milk consumption in the country. In 2008, Vietnam Gorvment issued the stretagy for livestck development to wards 2020 with an orientation of dairy cattle development in semi-intensive and intensive family farms. As a result, dairy enterprises had developed a big number of large scale dairy farms. Apperance of a big number of large scale dairy farms raised some questions for the future of dairy industry in Vietnam, especialy the soco-economic and environmeltal sustanability in dairy farms. This paper gave some discussion of how to do and what to do for the future of dairy industry in Vietnam.

Key words: *Dairy cattle, consumption, intensive, future.*

GIỚI THIỆU

Ở Việt Nam, sữa không phải là thực phẩm truyền thống và trước đây không được chú trọng sản xuất. Trong thế kỷ XX, mức tiêu thụ sữa đầu người của Việt Nam rất thấp và phần lớn sản phẩm sữa tiêu dùng trong nước là nhập khẩu. Nhập khẩu sữa và các sản phẩm sữa chững lại vào đầu những năm 1980, mức tiêu thụ giảm xuống mức 1 kg sản phẩm quy sữa/người vào năm 1983. Dưới ảnh hưởng của quá trình đô thị hóa và phát triển kinh tế (tốc độ tăng trưởng GDP trung bình 7,3% trong giai đoạn 1991-2000) (Worldbank, 2014), tiêu thụ sữa bắt đầu tăng đáng kể từ đầu những năm 1990 (Garcia, 2006). Mức tiêu thụ sữa bình quân đầu người đã tăng từ 1,4 kg năm 1990 lên 8,4 kg năm 2000 và 20kg năm 2013 sản phẩm quy sữa (FAO, 2014; Khôi, 2014). Tuy vậy, bò sữa vẫn chủ yếu được nuôi ở các nông trường và chỉ đáp ứng được 25-28% nhu cầu tiêu dùng sữa trong nước (Cục chăn nuôi, 2014). Với mức tăng dân số cao khoảng 1,2%/năm, thu nhập bình quân đầu người tăng 14,2%/năm, kết hợp với các xu thế cải thiện sức khỏe và tầm vóc người Việt khiến cho nhu cầu tiệu thụ các sản phẩm sữa luôn giữ mức tăng trưởng cao (AgroInfo, 2014). Để đáp ứng nhu cầu, Việt Nam đã nhập khẩu lượng lớn sữa bột. Các công ty đa quốc gia (như Nestlé, Friesland Campina, 3A, Mead Johnson, Abbott, Similac) từng bước thâm nhập vào thị trường Việt Nam với các sản phẩm sữa bột. Năm 2000, kim nghạch nhập khẩu sữa bột đạt 122 triệu USD. Xu hướng này vẫn giữ nguyên trong những năm 2000 do Việt Nam có cấu trúc dân số trẻ, tốc độ tăng trưởng kinh tế và quá trình đô thị hóa nhanh chóng (Nancy, 2008; Chung và Đăng, 2010). Theo số liệu của Hiệp hội sữa Việt Nam (2014), kim ngạch nhập khẩu sữa và các sản phẩm từ sữa tăng trung bình 15,6%/năm trong giai đoạn 2000-2009 (năm 2000: 140 triệu USD; năm 2007: 462 triệu

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USD; năm 2009: 520 triệu USD). Kể từ đầu những năm 2000, các chính sách đối với ngành sữa đã có sự điều chỉnh: Chính phủ hướng phát triển sản xuất sữa trong nước trên cơ sở thúc đẩy khu vực tư nhân.

MỤC ĐÍCH

Nhiều nghiên cứu về chăn nuôi bò sữa ở Việt Nam từ sau *Đổi mới* đã được thực hiện nhằm đề xuất chính sách và giải pháp cho chương trình phát triển sữa quốc gia. Trong những năm 2000, các nghiên cứu tập trung vào chăn nuôi bò sữa qui mô nông hộ, đặc biệt các mô hình chăn nuôi ở Mộc Châu, Ba Vì và Gia Lâm (miền Bắc), Đà Lạt và Củ Chi (ở miền Nam). Đầu những năm 1990, năng suất chăn nuôi bò sữa ở Việt Nam còn rất thấp (2,1-2,5 tấn/chu kỳ 305 ngày) (Đinh Văn Cải, 2009). Với việc nhập các nguồn gien và giống bò từ nước ngoài, năng suất chăn nuôi bò sữa đã được cải thiện, đạt tới 20 lít/ngày. Kết quả thực hiện chương trình phát triển chăn nuôi bò sữa khá tốt, góp phần thực hiện mục tiêu thúc đẩy sản xuất trong nước: Năng suất sữa ở bò lai từ 3,25 tấn/chu kỳ (2001) lên 4,0 tấn/chu kỳ (2010) và 4,28 tấn/chu kỳ (2013); Năng suất ở bò sữa thuần HF từ 4,26 tấn/chu kỳ (2001) lên 5,57 tấn/chu kỳ (2010) và 5,6 tấn/chu kỳ (2013); Năng suất bò sữa trung bình cả nước là 5,186 tấn/chu kỳ năm 2013. (Cục chăn nuôi, 2014).

Trong thời gian qua, ngành sữa Việt Nam đã phát triển nhanh chóng. Năm 2013, tổng đàn bò sữa trong nước đạt 186.388 con, tổng sản lượng sữa sản xuất ra đạt 456.392 tấn (Cục chăn nuôi, 2014). Chiến lược phát triển chăn nuôi năm 2008 đã có những điều chỉnh trong định hướng hỗ trợ phát triển các mô hình trang trại chăn nuôi để thúc đẩy hơn nữa sản xuất trong nước. Ngành sữa đã chuyển từ phát triển sản xuất dựa trên mối quan hệ giữa các các hộ chăn nuôi nhỏ, lẻ và các công ty chế biến sang xu hướng phát triển sản xuất dựa trên các trang trại tập trung quy mô lớn. Tiêu thụ sữa đã đạt gần 1triệu tấn sữa/năm. Số lượng các dự án đầu tư qui mô lớn vào các tổ hợp chăn nuôi-chế biến sữa ngày càng nhiều (như TH Milk, Hoàng Anh Gia Lai, ...). Tuy vậy, các nghiên cứu vẫn tập trung vào sản xuất nông hộ, chưa đi sâu vào những vấn đề liên quan tới xu hướng chuyển dịch trong phát triển chăn nuôi bò sữa: Sản xuất qui mô nhỏ và sản xuất qui mô lớn, đặc biệt là tính bền vững của ngành sữa và vai trò của các cơ sở chăn nuôi bò sữa qui mô nhỏ và vừa trong tương lai. Bài báo này tập trung vào 2 nội dung chính: (i) Tổng quan tình hình phân bố sản xuất chăn nuôi bò sữa hiện nay ở Việt Nam, và (ii) Thảo luận về các cơ hội và thách thức đối với việc phát triển chăn nuôi bò sữa tại Việt Nam dựa vào sản xuất nông hộ hay sản xuất theo qui mô trang trại.

TÀI LIỆU VÀ PHƯƠNG PHÁP

Bài viết dựa trên các thông tin kết hợp từ tổng hợp nguồn thông tin thứ cấp và các nghiên cứu và các khảo sát nhanh được thực hiện bởi Trung tâm Phát triển nông thôn và CIRAD ở Ba Vì (Hà Nội) và Nghĩa Đàn (Nghệ An) để có cái nhìn tổng quan về các thách thức đang đặt ra cho chăn nuôi bò sữa ở Việt Nam.

Các thông tin về các tác nhân chính hiện nay trong ngành sữa, bao gồm các công ty như Vinamilk, TH Milk, Cô gái Hà Lan (Dutch Lady), Sữa Mộc Châu và các tác nhân khác được hệ thống hóa. Thông tin chính thống từ các trang tin điện tử (www.vinamilk.com, www.THmilk.com, www.dutchlady, www.mochchau.com, www.bavi-jsc.com) và báo chí được sử dụng kết hợp để định vị sự phân bố các trang trại chăn nuôi bò sữa lớn trong cả

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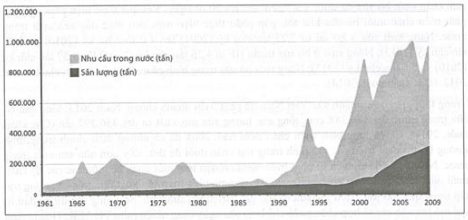
nước. Thông tin về các công ty (Afmilk, Deleval Professional Information) cung cấp hỗ trợ kỹ thuật (thiết bị, tư vấn, …) cũng được tham chiếu. Số liệu thống kê từ Tổng điều tra Nông thôn, nông nghiệp và thủy sản năm 2001 và 2011 được sử dụng để vẽ bản đồ các vùng sản xuất sữa ở Việt Nam. Hiệu quả kinh tế của các mô hình chăn nuôi bò sữa khác nhau (nhỏ, vừa và lớn) (Nghiên cứu của J.Laizzet, 2010 tại Ba Vì) và các vấn đề về tác động xã hội, môi trường trong chăn nuôi bò sữa (Khảo sát nhanh tại Nghĩa Đàn, tháng 7/2015) cũng được đề cập đến.

KẾT QUẢ

Một cuộc "Cách mạng trắng" ở Việt Nam? Tác động của các chính sách công



Nguồn: Faostat (2014)

Hình 1. Sản lượng sản xuất trong nước và tổng tiêu dùng trong nước (1961 – 2009)

Sản xuất sữa ở Việt Nam đã tăng lên nhanh chóng, tăng từ 8000 tấn năm 1961 lên 278.200 tấn năm 2009. Năm 2013, sản lượng sữa trong nước đạt 456.400 tấn tuy nhiên cũng chỉ mới đáp ứng được 30% nhu cầu tiêu thụ sữa trong nước (Faostat, 2014).

Các chính sách công đã có tác động tích cực tới sự phát triển chăn nuôi bò sữa và ngành sữa tại Việt Nam (Phong, 2009). Quyết định số 167/2001/QĐ-TTg ngày 26/102011 về một số biện pháp và chính sách khuyến khích hỗ trợ phát triển chăn nuôi bò sữa giai đoạn 2001-2010 đã thúc đẩy sản xuất sữa ở quy mô nông hộ. Trong thời gian này, chăn nuôi bò sữa được xem như một giải pháp xóa đói giảm nghèo ở các vùng nông thôn và ven đô. Từ năm 2000 đến năm 2006, chăn nuôi bò sữa phát triển nhanh chóng: Đàn bò sữa tăng từ 34.980 con lên 113.220 con, sản lượng sữa tăng từ 54.456 tấn lên 215.953 tấn (Cục chăn nuôi, 2014). Tuy nhiên, trong số 33 tỉnh, thành phát triển chăn nuôi bò sữa, chỉ có 11 tỉnh, thành phố đã triển khai thành công Chương trình, dẫn đến sự xuất hiện của một số huyện chuyên canh chăn nuôi bò sữa (Cục Chăn nuôi, 2007; Phong, 2009). Năm 2005, Chính phủ phê duyệt Quy hoạch tổng thể ngành công nghiệp sữa đến năm 2010, tầm nhìn 2020. Mục tiêu chính của Quy hoạch là đến năm 2010, sản lượng sữa trong nước đáp ứng được 40% nhu cầu tiêu dùng trong nước. Năm 2008, Thủ tướng ra quyết định phê duyệt Chiến lược Phát triển Chăn nuôi đến năm

2020, đưa ra một hướng đi mới cho ngành sữa theo hướng phát triển các trang trại thâm canh và công nghiệp hóa. Từ năm 2001 đến năm 2010, sản lượng sữa cả nước tăng từ 64.703 tấn lên 306.662 tấn (Faostat, 2014; Cục chăn nuôi, 2014). Sự phát triển này chủ yếu dựa vào sản xuất quy mô nhỏ. Năm 2010, khoảng 95% các cơ sở chăn nuôi bò sữa là các hộ gia đình (Tổng cục thống kê, 2011). Xét theo quy mô chăn nuôi năm 2010, chỉ có 9,3% tổng đàn bò sữa từ các trang trại có quy mô trên 20 con (FCV, 2011). Hai loại hình chăn nuôi tư nhân đang cùng tồn tại ở Việt Nam: Chăn nuôi nông hộ ở một số vùng chăn nuôi bò sữa tập trung (*Bản đồ 1*), chăn nuôi trang trại ở các địa phương được đầu tư để phát triển chăn nuôi bò sữa (*Bản đồ 2*). Các mô hình "khác biệt" trong ngành sữa đặt ra nhiều vấn đề cho sự phát triển bền vững của ngành.

Mở rộng quy mô chăn nuôi bò sữa tại Việt Nam

Chăn nuôi bò sữa ở nước ta còn phân tán, có tới 75% số lượng bò sữa được nuôi ở gần 24.000 hộ nông dân với quy mô chăn nuôi bình quân dưới 10 con (TCTK, 2014). Vì vậy, rất khó khăn trong công tác kiểm soát dịch bệnh cho vật nuôi, vệ sinh an toàn sữa, sản phẩm sữa không đồng đều về chất lượng. Cùng với những tiến bộ của khoa học kỹ thuật, nhu cầu thị trường và các chính sách công, chăn nuôi bò sữa ở Việt Nam đang đi theo hướng quy mô công nghiệp và đầu tư bài bản hơn. Mặc dù chăn nuôi nông hộ vẫn là chủ lực, nhưng sau 10 năm (2001-2010), số lượng cơ sở chăn nuôi quy mô lớn (trên 100 con, thậm chí trên 1000 con) đã xuất hiện.

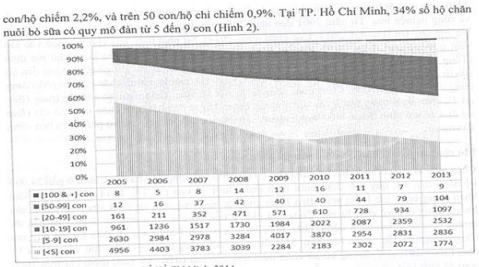
Bảng 1. Số cơ sở chăn nuôi bò sữa theo quy mô (2001, 2011)

Quy mô cơ sở chăn nuôi (con)	Tổng số cơ sở chăn nuôi		Tổng đàn (con)	
	2001	2011	2001	2011
[1-2]	8.035	24.184	11.780	32.210
[2-10]	5.896	11.425	28.061	58.827
[10-30]	364	2.371	5.821	39.403
[30-100]	16	183	728	7.871
[100-300]	1	7	110	815
[300-1000]	0	0	0	0
[1000 & +]	0	5	0	8.818

Nguồn: Tính toán từ Tổng điều tra nông thôn, nông nghiệp và thủy sản 2001, 2011.

Quy mô chăn nuôi bò sữa ở Việt Nam đang theo xu hướng quy mô đàn dưới 5 con đang giảm dần, quy mô từ 5-10 con trở lên tăng cao (Cục chăn nuôi, 2014). Năm 2013 (Tính trên số thống kê của 14 tỉnh và 4 doanh nghiệp chăn nuôi bò sữa (Cục chăn nuôi, 2014)), có 17.828 hộ chăn nuôi bò sữa cả nước, trong đó: Hộ chăn nuôi với quy mô dưới 5 con/hộ chiếm 36,7%, 5-10 con/hộ chiếm 35,5%,11-20 con/hộ chiếm 19,1%, từ 21-41 con/hộ chiếm 5,6%, từ 41-50

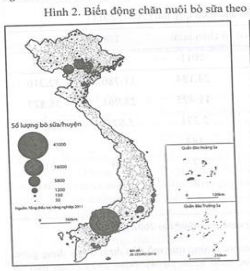
con/hộ chiếm 2,2%, và trên 50 con/hộ chỉ chiếm 0,9%. Tại TP. Hồ Chí Minh, 34% số hộ chăn nuôi bò sữa có quy mô đàn từ 5 đến 9 con (Hình 2).



	2005	2006	2007	2008	2009	2010	2011	2012	2013
[100 & +] con	8	5	8	14	12	16	11	7	9
[50-99] con	12	16	37	42	40	40	44	79	104
[20-49] con	161	211	352	471	571	610	728	934	1097
[10-19] con	961	1236	1517	1730	1984	2022	2087	2359	2532
[5-9] con	2630	2984	2978	3284	4017	3870	2954	2831	2836
[<5] con	4956	4403	3783	3039	2284	2183	2302	2072	1774

Nguồn : Sở NN&PTNT thành phố Hồ Chí Minh, 2014

Hình 2. Biến động chăn nuôi bò sữa theo quy mô tại Thành phố Hồ Chí Minh



Bản đồ 1. Quy mô đàn bò sữa theo huyện - 2011

Nguồn: Số liệu của Tổng điều tra nông thôn, nông nghiệp và thủy sản năm 2011

Bản đồ 2. Quy mô trang trại bò sữa - 2014

Nguồn: Số liệu tổng hợp từ số liệu công bố của Vinamilk, THMilk và kết quả Dự án Revalter (RUDEC-CIRAD), 2014

Các vùng chăn nuôi quy mô nhỏ truyền thống (từ cuối thế kỷ XX): Hướng đi giữa nền kinh tế bao cấp và nền kinh tế thị trường

Theo kết quả Tổng điều tra nông thôn, nông nghiệp và thủy sản 2011, sản lượng sữa tươi hàng năm của cả nước ước đạt 320.000 tấn với 37.000 hộ chăn nuôi và 140.000 bò sữa. Khoảng 65% đàn bò sữa đang trong thời kỳ sản xuất (cho sữa). Năng suất sữa trung bình là 10 lít/con/ngày. Và bình quân, mỗi hộ chăn nuôi sở hữu 2 con bò và 1,7 bê. Trang trại tư nhân lớn nhất nằm gần TP Hồ Chí Minh với 150 con bò sữa. Trong số 708 huyện của cả nước, chỉ có 14 huyện có qui mô đàn hơn 1.000 con bò sữa. 9 trong số 14 huyện trên sản xuất 70% lượng sữa tươi của cả nước. Các tỉnh miền Nam cung cấp 2/3 và các tỉnh miền Bắc cung cấp 1/3 tổng sản lượng sữa tươi của cả nước

Huyện Củ Chi (nằm ở phía tây bắc TP Hồ Chí Minh) sản xuất 30% lượng sữa tươi cả nước. Trước năm 1999, sản lượng sữa sản xuất tại TP Hồ Chí Minh chiếm 80% sản lượng sữa trong nước. Ở miền Bắc, ba vùng sản xuất sữa chính (Mộc Châu, Ba Vì, Gia Lâm) là những huyện mà trước đây có các nông trường quốc doanh (từ những năm 1950 đến những năm 1980). Các nông trường đã được chuyển đổi và mô hình sản xuất nông hộ đã phát triển mạnh tại đây từ những năm 2000. Ngày nay, khu vực sản xuất quy mô nhỏ đang tiếp tục quá trình chuyển đổi và phát triển theo hướng thâm canh và chuyên môn hóa (Hostiou và cs., 2012.). Hiện có khoảng 8% tổng số cơ sở chăn nuôi bò sữa theo phương thức thâm canh (Cục chăn nuôi, 2014) với mức độ đầu tư kinh tế (máy móc, công nghệ, …) và trình độ lao động ngày càng cao.

Đầu tư cho các trang trại lớn: Chiến lược quốc gia cho tương lai?

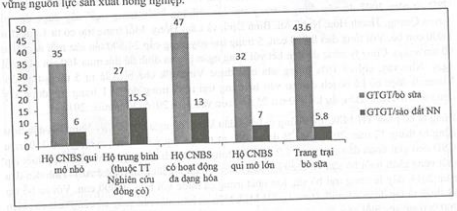
Những năm gần đây, ngành chăn nuôi bò sữa thu hút được rất nhiều sự đầu tư của các Công ty, tập đoàn tư nhân, như trường hợp của TH Milk, Future Milk, IDP, hay mới đây nhất là tập đoàn Hoàng Anh Gia Lai… Các trang trại này tập trung từ vài trăm đến hàng ngàn con, với hệ thống quản lý và công nghệ cao. Công ty Cổ phần Sữa Việt Nam (Vinamilk), doanh nghiệp dẫn đầu trong ngành sữa Việt Nam với doanh thu 1,5 tỷ USD năm 2013, đã đầu tư 38 triệu USD từ năm 2007 để xây dựng 5 trang trại lớn. Những "siêu trang trại" này được đặt tại Tuyên Quang, Thanh Hóa, Nghệ An, Bình Định và Lâm Đồng. Mỗi trang trại có từ 1.000 đến 3.000 con bò. Với tổng đàn 8.818 con, 5 trang trại này cung cấp 24.500 tấn sữa mỗi năm (tức 90 tấn/ngày). Công ty cũng đã liên kết với hàng ngàn hộ gia đình để thu mua 460 tấn sữa mỗi ngày. Như vậy, chỉ có 16% lượng sữa tươi được Vinamilk chế biến là từ 5 trang trại lớn. Vinamilk hiện có kế hoạch đầu tư vào ba trang trại mới, trong đó có 1 trang trại được xây dựng ở tỉnh Thanh Hóa, dự kiến sẽ đạt 25.000 con vào năm 2016 (Vinamilk, 2014).

Công ty cổ phần TH Milk, một công ty hàng đầu khác của ngành sữa Việt Nam, bắt đầu hoạt động từ tháng 12 năm 2010. Đây là dự án đầu tư tư nhân quy mô lớn với tổng vốn 350 triệu USD cho giai đoạn đầu (trong số 1,2 tỷ USD tổng kế hoạch đầu tư), dành cho việc thiết lập một vùng chăn nuôi bò sữa và chế biến sữa khép kín tại Nghĩa Đàn (Nghệ An). Tính đến đầu năm 2014, đây là trang trại bò sữa lớn nhất trong cả nước với hơn 30.000 con. Với sự hỗ trợ kỹ thuật từ tập đoàn Afimilk (Israel), TH Milk hiện sở hữu một nhà máy có công suất chế biến 200.000 tấn sữa mỗi năm.

Tính bền vững của ngành chăn nuôi bò sữa Việt Nam

Xét về hiệu quả kinh tế, tính bền vững của các mô hình chăn nuôi phụ thuộc vào các yếu tố bên ngoài (thức ăn, lao động…) luôn là một bài toán đặt ra. Hiệu quả kinh tế của các trang trại lớn thường được coi là cao hơn so với mô hình chăn nuôi nhỏ lẻ. Tại Mỹ, 40% lượng sữa được sản xuất bởi các trang trại có quy mô hơn 2000 con bò/trang trại, và chi phí sản xuất bình quân của các trang trại này là thấp hơn so với các trang trại có ít hơn 500 con bò (Woodforth, 2014). Tuy nhiên, không có bằng chứng cho thấy trong bối cảnh của Việt Nam, nơi có chi phí lao động thấp hơn nhiều, các trang trại quy mô lớn sẽ có hiệu quả cao hơn mô hình chăn nuôi nhỏ lẻ. Một số khảo sát được tiến hành ở Ba Vì cho thấy các hộ kết hợp chăn nuôi bò sữa với trồng trọt tạo ra giá trị gia tăng trên mỗi đầu bò và mỗi ha đất nông nghiệp cao hơn so với các trang trại (Lairez, 2012). Hơn nữa, do các trang trại lớn thường ít tự chủ trong nguồn thức ăn thô xanh nên chịu nhiều ảnh hưởng hơn khi có biến động giá thức ăn chăn nuôi. Ngoài ra, hiệu quả kinh tế cũng có thể được đánh giá ở cấp độ quốc gia, có tính đến nhu cầu nhập khẩu thức ăn chăn nuôi và tác động lên cán cân thương mại. So với nhu cầu thức ăn chăn nuôi hiện nay, nguồn cung các loại nguyên liệu giàu năng lượng (ngô, cám, lúa mỳ) thiếu khoảng 30-40%, thức ăn giàu đạm (đỗ tương, bột xương, thịt, bột cá) thiếu khoảng 70-80%, và các loại khoáng chất, vi lượng, phụ gia phải nhập khẩu 100%. Việc phải nhập khẩu nguyên liệu thức ăn chăn nuôi đồng nghĩa với việc người chăn nuôi phải gánh thêm chi phí về vận chuyển, kiểm định, thuế, rủi ro khi thức ăn không đạt chuẩn (AgroInfo, 2014). Sự phụ thuộc vào nguồn nguyên liệu thức ăn chăn nuôi nhập khẩu là một thách thức đặt ra trong xây dựng chiến lược phát triển bền vững ngành chăn nuôi Việt Nam nói chung và chăn nuôi bò sữa nói riêng.

Trang trại sữa Nghệ An của Vinamilk là trang trại đầu tiên của Vinamilk áp dụng và được cấp chứng nhận Global G.A.P là một dấu hiệu tích cực cho thấy các công ty sữa tại Việt Nam đã chú ý hơn tới việc đáp ứng các nhu cầu thị trường trong nước và quốc tế về chất lượng sản phẩm, về sản phẩm đảm bảo an toàn vệ sinh thực phẩm, nâng cao được chất lượng và bền vững nguồn lực sản xuất nông nghiệp.



Nguồn: Lairez, 2012

Hình 3. Hiệu quả kinh tế theo các kiểu hộ chăn nuôi bò sữa ở Ba Vì (triệu đồng)

Lợi ích xã hội cho người chăn nuôi bò sữa ở Việt Nam

Quy mô đất sản xuất trung bình của các nông hộ ở Việt Nam là 0,67 ha đất trồng cây hàng năm (Tổng cục Thống kê, 2012), và rất ít hộ chăn nuôi bò sữa có hơn 1 ha. Trong khi đó, một số công ty sữa đang quản lý những diện tích đất rất lớn.Ví dụ: trang trại bò sữa TH triển khai hoạt động trên vùng sản xuất rộng 8.100 ha ở huyện Nghĩa Đàn và đang có chiến lược mở rộng qui mô lên 37.000 ha trong giai đoạn thứ hai, với mục tiêu đạt 137.000 con bò sữa vào năm 2017 (TH, 2013). Những trang trại này tạo việc làm cho các lao động phổ thông, với mức lương khoảng 300 USD/tháng (Lairez, 2012). Trên thực tế, TH sử dụng 2.000 công nhân cho trang trại 30.000 con bò và nhà máy chế biến. Điều này tương đương với 1 công nhân cho 13 con bò, ít hơn 7 lần so với các hộ chăn nuôi (Hostiou và cs., 2012). Do đó, chăn nuôi ở nông hộ có mức độ thâm canh cao hơn nhiều.

Quản lý môi trường trong chăn nuôi bò sữa tạo sức ép lên các vùng lãnh thổ

Thách thức đang đặt ra với ngành chăn nuôi là vấn đề ô nhiễm môi trường và khí phát thải (CO_2, CH_4, N_2O) từ các hoạt động là rất lớn. Ngành chăn nuôi phát thải 18% lượng khí nhà kính (tương đương với 7,1 tỷ tấn CO_2) trên toàn cầu (FAO, 2006). Ô nhiễm từ chất thải chăn nuôi không chỉ ảnh hưởng nặng tới môi trường sống dân cư mà còn gây ô nhiễm nguồn nước, tài nguyên đất và ảnh hưởng lớn đến kết quả sản xuất chăn nuôi. Chăn nuôi bò sữa theo qui mô nhỏ tại hộ gia đình kết hợp với trồng trọt tạo nên một hệ thống nông nghiệp bền vững – với 1 lượng chất thải từ chăn nuôi không quá lớn, được xử lý bằng phương pháp sinh học (hầm biogas…), đủ để nông dân bón cho cây trồng của trang trại gia đình mình là nguồn dinh dưỡng nitơ, phốt pho, kali bổ sung cho cải tạo đất trồng…

Sự tập trung của hoạt động chăn nuôi bò sữa đòi hỏi phải có quy định chặt chẽ về quản lý môi trường. Các trang trại lớn phải giải quyết hai vấn đề cho người dân địa phương: sử dụng nước sạch và quản lý chất thải. Lượng nước cần thiết cho việc duy trì đàn bò sữa là rất lớn: 500 lít/con/ngày trong mùa khô. Các trang trại lớn sử dụng nước mặt và nước ngầm và có thể gây ra tình trạng thiếu nước trong mùa khô (Tham luận cá nhân của G. Firhue tại Tuyên Quang vào năm 2013).

Quản lý chất thải (phân, nước giải) cũng là một vấn đề quan trọng đối với các trang trại lớn. Các quy định về môi trường thường chưa đủ chặt chẽ để ngăn chặn các siêu trang trại gây ô nhiễm môi trường. Ở nhiều nơi, người dân phản nàn về mùi hôi và ô nhiễm nước mặt và nước ngầm. Hệ thống xử lý nước thải hiệu quả phải được cải thiện hơn nữa (ví dụ như hệ thống phục vụ sản xuất khí sinh học và xử lý nước thải để sản xuất phân bón).

KẾT LUẬN

Ngành chăn nuôi bò sữa của nước ta có nhiều thuận lợi để phát triển. Thị trường sữa nước ta còn rất lớn khi mà chăn nuôi bò sữa trong nước mới chỉ đáp ứng được 30% nhu cầu tiêu dùng nội địa. Những tiến bộ khoa học kỹ thuật và công nghệ cao trong chăn nuôi bò sữa đã hạn chế một phần bất lợi của điều kiện sinh thái, thời tiết khí hậu, đồng thời phát huy được tiềm năng, năng suất của đàn bò.

Nhằm phát triển nâng cao sức cạnh tranh các sản phẩm từ bò sữa trong quá trình hội nhập, việc phát triển đàn bò sữa không nên chạy theo số lượng mà cần ưu tiên chất lượng thông qua con giống và các mô hình sản xuất phù hợp hướng tới chăn nuôi bền vững, hiệu quả và đảm bảo an toàn vệ sinh thực phẩm. Trong tương lai, chăn nuôi bò sữa cần phát triển theo hướng quy mô trang trại, và đầu tư bài bản, ứng dụng công nghệ cao để đáp ứng nhu cầu ngày càng tăng. Tuy nhiên, vẫn cần bảo hộ mô hình chăn nuôi nông hộ vì đây vẫn là nguồn sinh kế cho người dân, giúp xóa đói giảm nghèo, tạo việc làm và phát triển kinh tế nông thôn. Chúng ta không thể xóa bỏ hoàn toàn mô hình này vì các doanh nghiệp vẫn cần có sự hỗ trợ nguồn sữa nguyên liệu từ các nông hộ.

Chăn nuôi bò sữa mang lại hiệu quả kinh tế cao. Tuy nhiên, sự phụ thuộc vào nguồn thức ăn nhập khẩu là một sức ép lớn lên tính cạnh tranh của ngành, nhất là trong bối cảnh hội nhập quốc tế sâu rộng (các hiệp định thương mại song phương, đa phương như EVFTA, TPP…). Trong khi đó, nếu biết khai thác, chế biến thức ăn cho vật nuôi từ nguồn phụ phẩm nông nghiệp đa dạng, phong phú trong nước (ước tính rơm rạ, thân ngô sau thu hoạch khoảng trên 50 triệu tấn) thì sẽ góp phần giảm sức ép về chi phí thức ăn chăn nuôi cho nông hộ và giúp giảm giá thành sản phẩm. Chăn nuôi bò sữa cần một tầm nhìn theo hướng xác định các vùng khuyến khích đầu tư phát triển, vùng không khuyến khích và không nên phát triển cũng như các mô hình và quy mô chăn nuôi hiệu quả. Cần có thêm các nghiên cứu sâu và rộng hơn về hiệu quả các mô hình chăn nuôi bò sữa (nông hộ, trang trại) trên tất cả các khía cạnh kinh tế, xã hội, môi trường để có thể có những giải pháp đồng bộ phát triển chăn nuôi bò sữa theo hướng bền vững.

TÀI LIỆU THAM KHẢO

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INTRODUCTION

Vietnam did not have any tradition of milk production and consumption until recently. During the XXth century, the milk consumption was low and mainly restricted to small quantities of imported dairy products. Those imports nearly stopped in early 1980s, falling down to per capita consumption of 1 kg milk equivalent in 1983. Driven by urbanization and economic development (annual GDP growth was averaged at 7.3% between 1991 and 2000) (World Bank 2014), the milk consumption started to increase significantly in the early 1990s (Garcia et al. 2006). Per capita dairy consumption jumped from 1.4 kg in 1990 to 20 kg of milk equivalent in 2003 (FAO 2014; Khoi and Dung 2014). This rapid rise of the demand for milk products has been driven by high demographic growth (1.2% per year), increase in per capita income (14.2% per annum), changes in diet patterns and particular customers' concerns about their health and physical look (AgroInfo 2014).

In order to meet growing demand, Vietnam imported massive quantities of milk powder. The multinational firms (Nestlé, Friesland Campina, 3A, Mead Johnson, Abbott, Similac) penetrated the Vietnamese market through exports of milk powder and setting up of milk processing industries. In 2000, imports of milk powder amounted to 122 million US dollars. They accounted for 95% of the domestic consumption. This trend continued during 2000s, thanks to the young population, rapid economic growth and quick urban development (Chung and Dang 2012; Morgan 2008). Vietnam Dairy Association (VDA) (2014) announced the growth of imports of milk and milk product was 15.6% on average during 2000-2009 (in 2000: US$ 140 million; in 207: US$: 462 million; in 2009: US$ 520 million).

In the beginning of the 2000s, however, the dairy sector policies shifted to a new generation of domestic dairy production support programs. Following the new market economy orientations and the collapse of the former State farms, those new governmental development programs focused on the development of smallholder private farming.

OBJECTIVE

There has been a number of researches on dairy sector since *Doi Moi* to propel public policies on National Dairy Development Program (NDDP). During 2000s, researches and studies targeted dairy production at farm level, especially dairy farming models in specific territories: Moc Chau, Ba Vi and Gia Lam (in the North), Da Lat and Cu Chi (in the South). Productivity of dairy cows was low, around 2.1-2.5 tons per cycle in 1990s (Cai 2009). Imported genetics and dairy cows have contributed to enhance the milk yield, reaching 20

liter per cow per day. The NDDP brought relatively positive results, contributing to push the local production. Milk productivity grew substantially: crossbred cow produced 3.25 tons per cycle (2001), 4.0 tons (2010), and 4.28 tons (2013). For purebred HF dairy cows, productivity per cycle increased from 4.26 tons (2001) to 5.57 (2010) and 5.6 tons (2013). At national level, milk productivity is averaged at 5.186 tons per year (2013) (DLP 2014).

The dairy sector has undergone a significant growth over the past 20 years. In 2013, the national dairy herd was recorded 186,388 cows with the total milk output of 456,392 tons (DLP 2014). The national Livestock Development Strategy to 2020 (DLP 2008) prioritizes supports towards the large-scale farms and facilities in order to satisfy the growing local demand. The dairy sector has shifted from production based on the linkage and partnership between small farmers and processing companies to the production based on concentrated mega-farms. Annual milk consumption reaches about 1 million tons. Despite more bigger investments have been placed on complex of dairy farming and processing (TH Milk, Hoang Anh Gia Lai, etc.), researches continue to more focus on smallholder dairying rather than transition dynamics occurring in the sector: general trajectory of smallholder farming and industrial farms, especially sustainability of the dairy sector and the role of small and medium dairy farms in the future. This paper aims to: (1) give an overview of the current geography of dairy production in Vietnam; and (ii) discuss opportunities and challenges facing the dairy sector in regard of opposition between small and large-scale dairy farms.

MATERIALS AND METHODOLOGY

In addition to the consolidated secondary data from available literature, rapid assessment and field missions carried out by RUDEC and CIRAD in Ba Vi (Ha Noi) and Nghia Dan (Nghe An) are done to sketch the current situation and challenges facing the dairy production in Vietnam.

Information about key actors in the local diary industry (Vinamilk, TH Milk, Dutch Lady, Moc Chau Milk) and other stakeholders are documented from official websites[95] and public press to localize the dairy mega-farms across the country. Profiles of international players (Afimilk, Deleval Professional Information) that supply inputs and services (equipment, facilities, consultancy, etc.) are referred. Statistics of AgroCensus 2001 and 2011 are used to produce the maps on dairy zones in Vietnam. Economic performance of family dairying (small, medium and large size) (Lairez 2012 in Ba Vi) and emerging social

[95] www.vinamilk.com, www.THmilk.com, www.dutchlady, www.mochchau.com, www.bavi-jsc.com

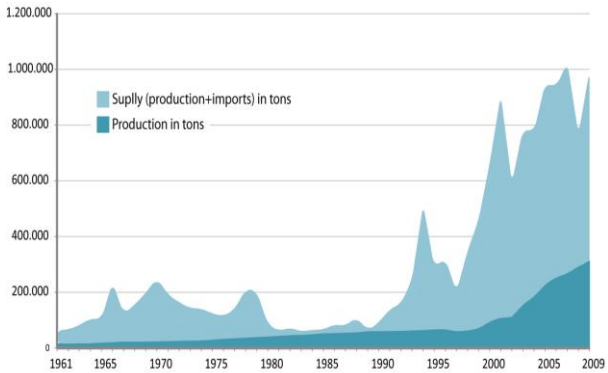
and environmental concerns in dairy farming (Rapid assessment in Nghia Dan in July 2015) are synthesized when looking at different dairy farming models in Vietnam.

RESULTS AND DISCUSSION

A «white revolution» in Vietnam? Impact of national policies

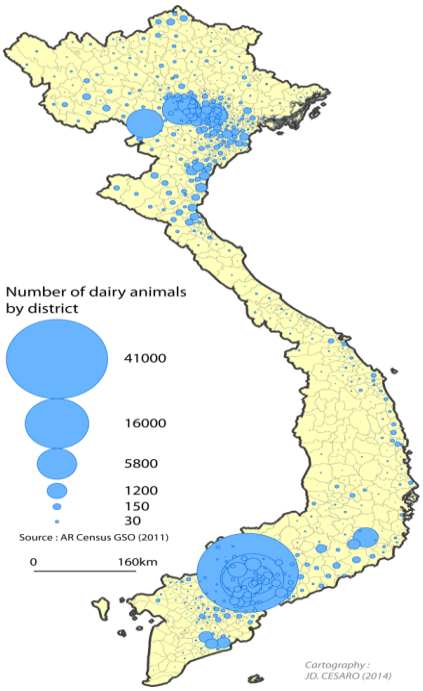
Public policies have positive impact on the dairy production and the dairy sector in Vietnam (Phong 2009). The Decision 167/2001/QD-TTg dated on 26 October 2001 on encouraging the dairy production for the 2001-2010 period drove the development of dairy production at household farms. During this period, dairy production was perceived as tools for poverty reduction in rural and peri-urban areas. Dairy production exploded between 2000 and 2006: dairy herd increased from 34,980 cows to 113,220 cows, milk output went up from 54,456 tons to 215,953 tons (DLP 2014). However, out of 33 provinces having endorsed the dairy development programs, only 11 provinces and cities succeeded in implementing the NDDP components, leading to the emergence of some districts specialized in dairy farming (DLP 2007; Phong 2009). The Master Plan for development of dairy industry to 2010, vision 2020 was passed in 2005 aiming at 40% of milk self-sufficiency by 2010. The national Livestock Development Strategy to 2020 (launched in 2008) pinpoints a new pathway for the local dairy sector to follow: expansion of intensive and industrialized large-scale farms. The national dairy production quintupled from 64,703 tons in 2001 to 306,662 tons in 2010 (FAO 2014; DLP 2014) by the development of smallholder dairying. In 2010, about 95% of the dairy holdings are smallholders (GSO 2012). Only 9.3 of the national dairy herd are raised in the dairy farms of more than 20 cows (FCV 2011). Two types of private milk farms co-exist now in Vietnam: households farms in a limited number of districts specialized in dairy production (Figure 2), and mega-farms located in areas where large private investments were possible (Figure 3). These “differentiated” profiles of the dairy sector raise many questions in terms of sustainability.

Figure 1: Domestic supply versus domestic production in Vietnam (1961-2009)



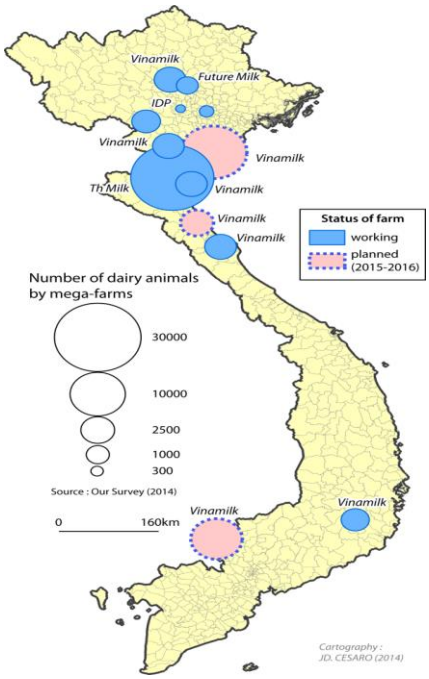
Source: FAOstat (2014)

Figure 2: Dairy production by district in 2011



Source: AgroCensus, 2011

Figure 3: Large scale farms by district in 2014



Source: Statistics computed from official report of Vinamilk, TH Milk and data consolidation of Revalter project (RUDEC-CIRAD, 2014)

The Scaling Up of Dairy Production in Vietnam

Dairy farming in Vietnam is still scattered taking into account of 75% of the herd raised in nearly 24,000 household farms of under 10 cows (GSO 2014). Thus, it is very difficult to control animal diseases and food safety and ensure the homogeneous quality of milk. The combination of technological advances, market demands and public policies has motivated dairy production in Vietnam to spread industrial investments and to establish integrated structures. While the household dairying still dominates, after 10 years (2001-2010), we have seen more and more large-scale and mega farms (more than 100, or even 1000 dairy cows).

Dairy farms in Vietnam is following the trend: decrease in number of under-5-cow herds, increase in 5-to-10-cow herd (DLP 2014). Out of 17,828 dairy farms in 2013 (statistics of 14 provinces and 4 dairy enterprises (DLP 2014)), there are 36.7% of dairy farms of under 5 cows, 35.5% of dairy farms of 5-10 cows, 19.1% of farms of 11-20 cows, 5.6% of

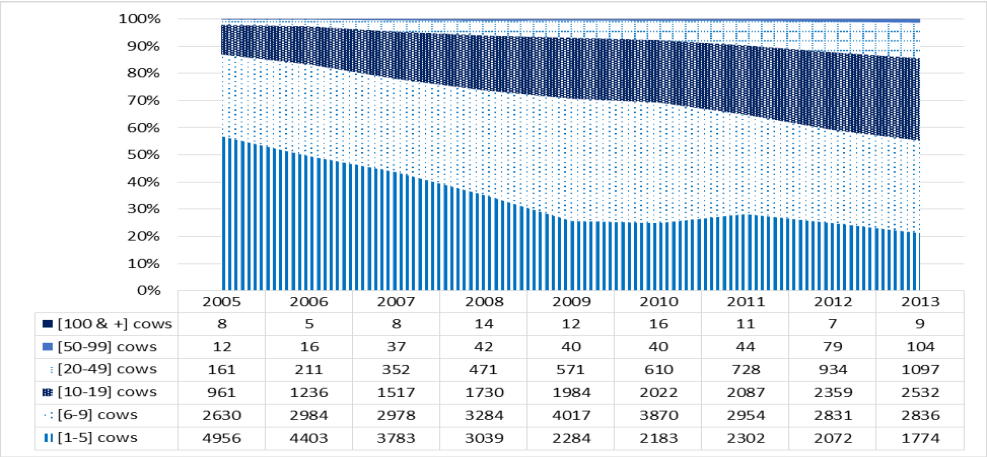
farms of 21-41 cows, 2.2% of farms of 41-50 cows and 0.9% farms of more than 50 cows. In Ho Chi Minh City, 34% of dairy farms having from 5 to 9 cows (Figure 4)

Table 1 : Expansion of dairy farms by herd size (2001, 2011)

Dairy farm size (dairy cows)	Total holdings (farms)		Total herd (cows)	
	2001	2011	2001	2011
[1-2]	8,035	24,184	11,780	32,210
[2-10]	5,896	11,425	28,061	58,827
[10-30]	364	2,731	5,821	39,403
[30-100]	16	183	728	7,871
[100-300]	1	7	110	815
[300-1000]	0	0	0	0
[1000 +]	0	5	0	8,818

Source: Computation from AgroCensus 2001, 2011

Figure 4 : Changes in scale of dairy farms in Ho Chi Minh City



Source: DARD of Ho Chi Minh, 2014.

- *Traditional small-scale Dairy Territories (since the late XXth century): a pathway between central planning economy and market economy*

According the Census of Rural, Agriculture and Fishery 2011 (GSO 2012), the national production of fresh milk was estimated at 320,000 tons. 140,000 dairy cows were raised in 37,000 dairy households. Around 65% of the national dairy herd was in production (milking cows). On average, a cow produced 10 liters milk a day and a farm owned 2 cows and 1.7 calves. The biggest dairy family farm is located in the suburban of Ho Chi Minh City with 150 dairy cows. Among 708 districts throughout the country, only 14 have more than 1000 dairy cows. Those 9 districts account for 70% of the national fresh milk production. The South of Vietnam gathers two-third of national production while Northern provinces produce one-third.

The district of Củ Chi (Northwest to Ho Chi Minh City) produces 30% of national fresh milk. Before 1999, Ho Chi Minh City accounted for 80% of the national milk production. In

the North Vietnam, the three main dairy production regions (Mộc Châu, Ba Vì, Gia Lâm) are districts where former state agro-forestry farms were run during the collectivist period (1950s to 1980s). These state farms were then privatized, that have facilitated a new development dynamic based on smallholder farmers in those districts since 2000. Today, this small-scale production sector is changing progressively towards more intensive and specialized production systems (Hostiou et al. 2012). About 8% of the dairy holdings is currently pursuing intensive production (DLP 2014) and of intensive investment (machinery, technology, etc.) and recruiting skilled labors.

- *New investments in mega-farms: a national strategy for future?*

Dairy production has captured interest of big companies and groups recently: TH Milk, Future Milk, IDP and Hoang oGia Lai, etc. Those farms concentrate from several hundreds to thousands of dairy cows in a single location with the most modern and advanced management and technology. The Vietnam Dairy Product Joint-Stock Company (Vinamilk), who is the leader in the Vietnamese dairy sector with a revenue of US$1.5 billion in 2013, invested US$ 38 million since 2007 to build 5 large-farms in provinces of Tuyên Quang, Thanh Hóa, Nghệ An, Bình Định and Lâm Đồng. Each "mega-farm" has between 1000 and 3000 dairy cows. With a total herd of 8,818 cows, those 5 "mega-farm" produce 24.500 tons per year (or 90 tons/day). Vinamilk sources 460 tons fresh milk a day from thousands of contracted households farms, while 16% of the fresh milk processed by the company comes from the 5 mega-farms. Vinamilk plans to invest in three news farms, one of which (located in Thanh Hóa province) is expected to accommodate 25,000 heads by 2016 (Vinamilk 2014).

TH Milk Food Joint Stock Co., another major dairy enterprise in Vietnam, has come into operation since December 2010. This large-scale private investment project of US$350 million for its first phase (US$1.2 billion for the total investment project) devotes to set up an important dairy farming and processing industry in the central province of Nghệ An. TH farms has the largest herd of 30,000 dairy cows by 2014. Technically supported by Afimilk, an Israeli company, TH Milk Group also owns a processing factory that has a capacity to process 200,000 tons of milk per year.

Questions on the Sustainability of dairy production in Vietnam

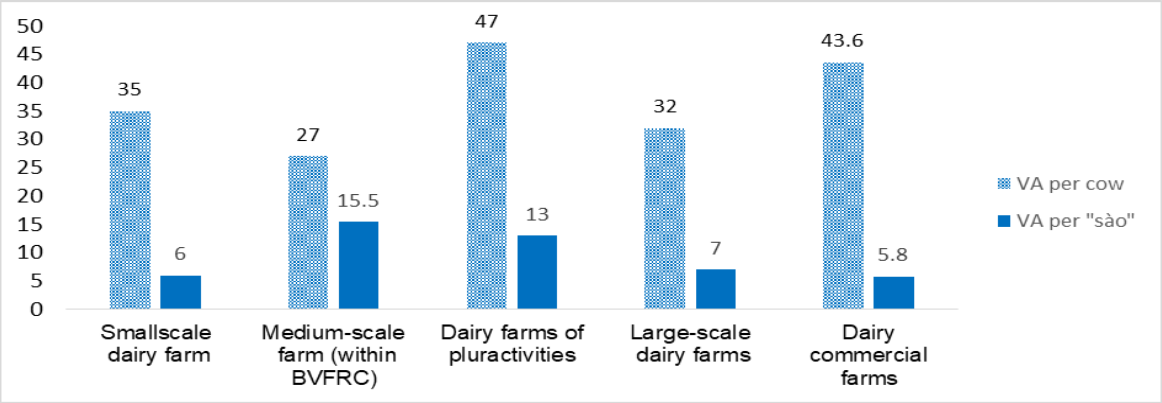
- *Economic performance: dependency from outside, a rational economic model?*

From the perspective of economic efficiency, dependency on external factors (feed, labor, etc.) is concerned by all involved actors. Mega-farms are always considered to be more economically efficient than smallholder farms. In the United States, 40% of the milk is produced by farms of more than 2000 cows, which have average production costs lower

than farms with less than 500 cows (Woodford 2014). However, there is no clear evidence that in the context of Vietnam, where the cost of labor is much lower, large-scale farms will be more efficient that small ones. Some preliminary surveys conducted in Ba Vi show that small farmers engaged in both dairy cows and crop production generate a higher added value per cow and per hectare than the commercial farms (Lairez 2012). Moreover, commercial dairy farms are more sensitive to feed price volatility as they are generally less self-sufficient in fodder. In addition, economic efficiency might also be considered at the national level, taking into account the demand for imports of feeds and impact on those imports on the trade balance. Given the current feed demand, local dairy sector runs huge deficits of feed ingredient supplies: 30-40% for energy-rich ingredients (corns, brans, barley), 70-80% for protein-rich feed (soybean, bornmeal, fishmeal), while minerals, micronutrients, and additives are totally subject to imports. Importation of feed ingredients means that breeders suffer from additional costs of transportation, quality control, tax, risks when feed is not satisfied (AgroInfo 2014). Dependence on the imported feed is a challenge facing policy makers in constituting a new strategy for sustainable development of livestock sector in Vietnam in general and for dairy sector in particular.

Vinamilk farm in Nghia Dan district (Nghe An province) is the first dairy farm in Vietnam being awarded Global GAP certification. It is a positive signal to show that Vietnamese dairy corporations have paid more attention to meet the domestic and international quality requirements and food safety norms, improving quality and sustainability of agricultural resources.

Figure 5 : Economic efficiency by size of dairy farms in Ba Vi district (million dong)



Source: Lairez (2012)

- *Social Equity Peasant question in Vietnam dairy sector: Who wins? Who loses?*

The average size of agricultural household farms in Vietnam is 0.67 ha of annual cropland (GSO 2012) and only few farms more than 1 ha of farmland. However, some

dairy companies manage to access large pieces of land. TH milk farm, for example, has developed its activities on 8,100 ha in Nghia Dan District and is planning, for its second phase, a surface of 37,000 ha and137,000 dairy cows by 2017 (TH Milk 2013). Jobs on farms are offered to non-skilled workers who get monthly paid around US$300 (Lairez 2012). In reality TH milk farm employs 2000 workers on the 30,000-cow farm blocks and a processing plant. In this production model, 1 active worker in charge of 13 cows, that is 7 times less than smallholder farms (Hostiou et al. 2012). Family farming is therefore much more labor intensive.

- *Environmental justice when dairy production stress local territories*

Challenges posed to the livestock sector is the environmental pollution and greenhouse emissions (CO_2, CH_4; N_2O) from livestock activities. Livestock sectors is said to account for 18% of the global greenhouse emissions (equivalent to 7.1 billion tons CO_2) (Steinfeld et al. 2006). Pollution from livestock waste not only badly affects living environment but also resulted in the pollution of air, watercourses, and soil and production activities. Family dairying in mixed farm (crop-livestock) constitutes a sustainable system with a modest quantity of waste from livestock rearing to be treated with biological methods (biogas, compost…) into useful soil conditioner or fertilizer that return nutrients to the soils (nitrogen (N), phosphorus (P), and potassium (K)) and ensure healthy crops.

The concentration of dairy cows requires strict environmental rules. Large-scale farms and mega- farms confront two critical problems related to the living landscape of local people: water use and effluence management. Dairy production requires a huge water quantity: 500 liter per cow per day during dry seasons. Large-scale dairy farms use surface water and groundwater might cause problems of water shortage in the dry season (interview with G. Firhue, Future Milk, in Tuyen Quang, 2013).

Livestock waste management (effluence, solid, slurry) is proved to be a big issue for large-scale farms. Environmental regulations are not strict enough to prevent the environmental pollution caused by mega-farms. In many locations, residents complain about odors and pollution of watercourse (surface and ground). Efficient waste treatment systems must be further developed (biogas systems, effluent treatment, etc.) to mitigate production of pollutants (noxious gas, harmful pathogens, and odors) in order to protect environment.

CONCLUSION

The domestic dairy production in Vietnam has shown a strong ability to develop. However, the local milk market remains huge and the domestic production only satisfies 30% of the local demand. Technical and technological innovations in the dairy production

have limited the environmental constraints, as well as enhanced potentials and yields of the dairy herd.

In view of a better competitiveness of the dairy products in the international integration process, the dairy production should follow prioritize quality rather than quantity through improved breeding and relevant production models towards sustainable livestock and food safety. In the future, dairy production will certainly be characterized by commercial and industrial dairying, and advance technology, to meet the increasing demand. However, it still appears crucial to support the smallholder dairying as it represent important livelihoods for the farmers, contributing to poverty reduction, social improvement, job creation and rural economy promotion. Small farmers will not be simply eliminated, as they important are suppliers of milk to firms and enterprises.

Dairy production brings economic returns. However, the dependence on imported feed has put great pressure on the competitiveness of the sector, especially in the context of deeper and broader integration (bilateral and multilateral agreements like EVFTA, TPP, etc.). Meanwhile, a variety of agricultural byproducts and residues produced at home (post-harvested crop residues (brans, corn tube, cassava tube) are estimated around 50 million tons a year) would help to relieve the dependence on feed costs for farmers and cut the production costs. Dairy production needs a comprehensive and viable development vision, especially dairy zoning (concentration zone, zone free of dairy production, etc.) and relevant farm models. Further studies are needed to assess efficiency of the dairy production holdings (households, farms) on different perspectives (economic, social, and environmental) to work out appropriate policies solutions for sustainable and inclusive dairy development.

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